19 Skates in the Bay of Biscay and Iberian Waters (ICES Subarea 8 and Division 9.a)

ICES uses the generic term “skate” to refer to all members of the order Rajiformes. The generic term “ray”, formerly used by ICES also to refer to Rajiformes, is now only used to refer to other batoid fish, including manta rays and sting rays (Myliobatiformes), and electric rays (Torpediniformes). ICES only provides routine advice for Rajiformes.

19.1 Ecoregion and stock boundaries

The Bay of Biscay and Iberian Waters ecoregion covers the Bay of Biscay (divisions 8.a-b and 8.d), including the Cantabrian Sea (Division 8.c), and the Spanish and Portuguese Atlantic coast (Division 9.a). This ecoregion broadly equates with the area covered by the South Western Waters Advisory Council (SWWAC). Commercially-exploited skates do not occur in the offshore Division 8.e to any significant extent.

The northern part of the Bay of Biscay has a wide continental shelf with flat and soft bottom more suitable for trawlers, whilst the Cantabrian Sea has a narrower continental shelf with some remarkable bathymetric features (canyons, marginal shelves, etc.). The Portuguese continental shelf (Division 9.a) is narrow, except for the area located between the Minho River and the Nazaré Canyon, and in the Gulf of Cadíz, where it is about 50 km wide, particularly to the east. The slope is mainly steep with a rough bottom including canyons and cliffs.

Rajidae are widespread throughout this ecoregion but there are regional differences in their distribution as described in earlier reports (ICES, 2010), and this is particularly evident for those species with patchier distributions and limited dispersal (Carrier *et al*., 2004).

Skates in this ecoregion include thornback ray *Raja clavata*, cuckoo ray *Leucoraja naevus*, the less frequent blonde ray *Raja brachyura*, small-eyed ray *R. microocellata*, brown ray *R. miraletus*, spotted ray *R. montagui*, undulate ray *R. undulata*, shagreen ray *Leucoraja fullonica*, common skate *Dipturus batis*-complex, (recently split into *D. batis* and *D. intermedius*), long-nosed skate *D. oxyrinchus*, sandy ray *Leucoraja circularis* and white skate *Rostroraja alba*.

Studies undertaken in the centre of Portugal (Division 9.a; Serra-Pereira *et al*., 2014), and in the Cantabrian Sea (eastern parts of Division 8.c) indicate spatial overlap between *R. clavata* and *L. naevus* (e.g. Sánchez, 1993). In the Bay of Biscay, *L. naevus* is more abundant on the offshore trawling grounds (Sánchez *et al*., 2002). Along the Portuguese coast *R. clavata* and *L. naevus* co-occur in areas deeper than 100 m, on grounds composed of soft bottom, from mud to fine sand (Serra-Pereira *et al*., 2014). *Raja clavata* can also be found from rocky to coarse sandy bottoms. *Raja brachyura* occurs primarily near the coast in shallower depths in areas of rocks surrounded by sand. Juvenile *R. brachyura*, *R. montagui* and *R. clavata* co-occur on grounds shallower than 100 m. In this ecoregion, *R. undulata* and *R. microocellata* occur at depths < 40 m over sandy bottoms. *R. undulata* is locally common in the shallow waters between the Loire and Gironde estuaries (eastern Bay of Biscay; divisions 8.a-b) and occurs along most of the French coastal.

The geographical distributions of the main skate species in the ecoregion are known, but their stock structure still needs to be more accurately defined. Studies (e.g. tagging and/or genetic studies) to better understand stock structure are required.

A tagging survey of *R. undulata* carried out in the Bay of Biscay (2012–2013) showed that movements of this species were limited to *ca.* 30 km (Delamare *et al*., 2013 WD; Biais *et al*., 2014 WD).

This result supports the hypothesis that several local stocks exist in European waters and corroborates the assumption of three distinct assessment units (divisions 8.a–b; 8.c and 9.a) in this ecoregion.

For most other skate species, WGEF considers two management units in this ecoregion: Subarea 8 (Bay of Biscay) and Division 9.a (Iberian waters). Since 2015, the cuckoo ray from ICES subareas 6 and 7 in the Celtic seas ecoregion and the Bay of Biscay is considered to form one single stock, cuckoo ray in subareas 6 and 7 and divisions 8.a-b,d. In addition, there are two stocks of cuckoo ray in this ecoregion: in Division 8.c (Cantabrian Sea) and Division 9.a (Iberian waters).

19.2 The fishery

19.2.1 History of the fishery

In the Bay of Biscay and Iberian waters, skates are caught mainly as a bycatch in mixed demersal fisheries, which target either flatfish (including sole) or gadiforms (e.g. hake). The main fishing gears used are otter trawl, bottom-set gillnets and trammel nets. The countries involved in these fisheries are France, Spain and Portugal, as detailed below.

France

Skates are traditional food resources in France, where target fisheries were known to occur during the 1800s. In the 1960s, skates were taken primarily as a bycatch of bottom trawl fisheries operating in the northern parts of the Bay of Biscay, the southern Celtic Sea and English Channel. By this time, *R. clavata* was targeted seasonally by some fisheries, and was the dominant skate species landed. After the 1980s, *L. naevus* became the main species landed. However, landings of both *R. clavata* and *L. naevus* declined after 1986.

Other skates are also landed, including *L. circularis*, *L. fullonica*, *R. microocellata, D. batis* complex (mostly blue skate), which is included in prohibited species by the EU regulation since 2010, and *D. oxyrinchus*. There have been no major annual landings of *Rostroraja alba* by French fleets in the past three decades.

The historical French catches of skates in coastal fisheries are poorly known. Most landings of skates and rays were not reported by species before 2009 where species-specific reporting of landings was required by the EU regulation. For *Raja undulata,* this imply that no species-specific landings were reported before its inclusion on the EU prohibited species list and past levels of catch are unknown.

Spain

Spanish demersal fisheries operating in the Cantabrian Sea (Division 8.c) and Bay of Biscay (divisions 8.a-b and 8.d) catch various skate species using different fishing gears. Most landings are a bycatch from trawl fisheries targeting demersal teleosts, (e.g. hake, anglerfish and megrim). Among the skate species landed, *L. naevus* and *R. clavata* are the most frequent. Historically, due to their low commercial value, most skate species, especially those derived from artisanal gillnetters, were reported as Rajidae. There are artisanal gillnet fisheries operating in bays, rias and shallow waters along the Cantabrian Sea and Galician coasts (divisions 8.c and 9.a). *R. undulata* is caught mainly in the coastal waters of Galicia (northern part of Division 9.a and western part of Division 8.c) where it was frequently landed and one of the most abundant species inside the rias. Other skate species caught in Galician waters include *R. brachyura*, *R. microocellata*, R. *montagui*, *R. clavata* and *L. naevus*. The characteristics of Spanish artisanal fleets catching skates are not fully known.

Mainland Portugal

Off mainland Portugal (Division 9.a), skates are caught mainly by the artisanal polyvalent fleet with a smaller contribution of trawlers to landings. The artisanal fleet operates mostly with trammel nets, but other fishing gears (e.g. longlines and gillnets) are also used. The skate species composition of landings varies along the Portuguese coast. *R. clavata* is the main species landed, but *R. brachyura*, *L. naevus* and *R. montagui* are also caught. Before being prohibited, *R. undulata* was frequently landed, particularly at the northern landing ports. Other species, such as *R. microocellata*, *D. oxyrinchus*, *R. miraletus*, *R. alba* and *L. circularis,* are also caught, albeit less frequently (particularly the latter three species). Further details on fisheries in Division 9.a are given in Stock Annexes.

19.2.2 The fishery in 2020

COVID-19 is expected to have affected fishing activity in 2020, although so far unquantified, with national or local restrictions on fishing activity reducing fishing effort for at least part of the year.

Apart from COVID-19, no other clear changes are noted for 2020, with descriptions of recent investigations provided below.

France

Landings and on-board observation data confirm that skates are primarily a bycatch in numerous fisheries operating in the Bay of Biscay. French landings statistics from more than 100 métiers (defined at DCF level 6) report landings of *R. clavata* and *R. montagui* in the Bay of Biscay. Trammel nets are the main métier for *R. montagui*, while twin-trawl is the main métier for *R. clavata*.

Spain

The results from the DCF pilot study held from 2011–2013 and conducted in the Basque Country waters (Division 8.c) with the objective of describing and characterizing coastal artisanal fisheries (trammel nets targeting mainly hake, anglerfish and mackerel), showed that several skate species (*R. clavata*, *R. montagui*, *L. naevus*, *L. fullonica, L. circularis, R. brachyura* and *R. undulata*) are caught as bycatch. The Basque artisanal fleet consists of 55 small vessels that use gillnets and trammel nets during some periods of the year. Vessels have an average length of 12.7 m and an average engine power of 82.4 kW. The proportions of skates in the total sampled trips were 30% (2011), 35% (2012) and 16% (2013). The estimated landings of skates by this fleet were 19.3 t in 2012 and 26.9 t in 2013 (Diez *et al.*, 2014 WD).

In the Cantabrian Sea (Division 8.c) most skate landings are also from bycatch from otter trawl (47%) and gillnet gears (43%). The remaining landings are derived from longlines and other fishing gears.

Mainland Portugal

Skates are mainly a bycatch in mixed fisheries, particularly from the artisanal polyvalent fleet (representing around 80% of landings). Set nets (mainly trammel nets), or a combination of set nets and traps, account for most skates' landings (*ca.* 72% in weight and 78% in number of trips in 2020), followed by longline (*ca.* 11% in weight and 11% in number of trips in 2020). Also, within the artisanal polyvalent fleet, small trawlers may account for 5% in weight and 6% in number of trips of the total landings of skates and rays, being only observed in certain landing ports. Methods to estimates landings by skate species were developed during the DCF-funded pilot study focused on skate catches in Portuguese continental fisheries carried out from 2011 to 2013 (Maia *et al.*, 2013 WD).

The experimental quota of *R. undulata* assigned to Portugal since 2016 requires a special fishing license for this species. Vessels, with the license are mainly operating close to the coast. This fishery is TAC constrained and has as the main goal to provide fishery data for future scientific advice.

19.2.3 ICES Advice applicable

Before 2012, ICES provided general advice on skates, but this is inadequate as skate species have different life-history traits. Also, a generic skate TAC does not take into account that several stocks straddle the boundary with other management areas. For instance, *L. naevus* is a stock straddling subareas 6 and 7 (excl. Division 7.d) and divisions 8.a-b and 8.d.

From 2012–2014, ICES has moved towards providing advice at the individual stock level, giving quantitative advice where possible.

Advice on skates is given biannually and the last advice provided for Bay of Biscay and Iberian Waters ecoregion was given in 2020 (for 2021 and 2022). For most stocks a landings advice was given, a summary of these and details for stock not subject to a landings advice or for which the advice was more complex is summarised in the table below.

It is important to note that this does not sum up to a generic advice for skates in subareas 8 and 9 and should not be interpreted as advice in relation to the generic skate TAC applicable to this management area.

Scientific name	ICES stock code	Management unit	Catches/Landings advice for 2021 and 2022 (tonnes)	Advice basis
Raja undulata	rju.27.8ab	8.a,b	Catches should be no more than 202 tonnes of which no more than 13 tonnes should be landed	Catches
Raja undulata	rju.27.8c	8.c	No targeted fisheries, manage bycatch	
Raja clavata	rjc.27.8	8	389	Landings
Leucoraja naevus	rjn.27.8c	8.c	Catches should be no more than 42 tonnes of which no more than 31 tonnes should be landed	Catches
Raja montagui	rjm.27.8	8	129	Landings
Raja montagui	rjm.27.9a	9.a	108	Landings
Leucoraja naevus	rjn.27.9a	9.a	Catches should be no more than 120 tonnes of which no more than 84 tonnes should be landed	Catches
Raja clavata	rjc.27.9a	9.a	1717	Landings
Raja undulata	rju.27.9a	9.a	31	Landings
Raja brachyura	rjh.27.9a	9.a	254	Landings
Dipturus batis complex (Dipturus batis) (Dipturus intermedius)	rjb.27.89a	8, 9.a	No advice requested	
Other skates	raj.27.89a	8, 9.a	ICES cannot provide catch advice	

19.2.4 Management applicable

An EU TAC for skates (Rajiformes) in subareas 8 and 9 was first established in 2009, and set at 6423 t. Since then, the TAC was reduced by approximately 15% in 2010, 15% in 2011, 9% in 2012, 10% in 2013, 10% in 2014, remained stable in 2015 and 2016, and increased by 9% in 2017, 15% in 2018, 10% in 2019, remained stable in 2020, and increased by 8% in 2021. The history of the EU regulations adopted for skates in this ecoregion and the ICES landings estimates for all Rajiformes (excluding *Raja undulata* from 2014 onwards, where subTACs were set for this species from 2015 in Subarea 8 and from 2016 in Division 9.a) is summarized below:

Year	TAC for EC waters of subareas 8 and 9	ICES landing estimates	Regulation
2009	6423 t	4327 t	Council Regulation (EC) No 43/2009 of 16 January 2009 (1,2)
2010	5459 t	4140 t	Council Regulation (EU) No 23/2010 of 14 January 2010 (1,2)
2011	4640 t	4144 t	Council Regulation (EU) No 57/2011 of 18 January 2011 (1,2)
2012	4222 t	3766 t	Council Regulation (EU) No 43/2012 of 17 January 2012 (1,2)
2013	3800 t	3686 t	Council Regulation (EU) No 39/2013 of 21 January 2013 (3,2)
2014	3420 t	3685 t	Council Regulation (EU) No 43/2014 of 20 January 2014 (3,2)
2015	3420 t	3507 t	Council Regulation (EU) No 104/2015 of 19 January 2015 amended by the Council Regulation (EU) No 523/2015 of 25 March 2015 (3,4)
2016	3420 t	3296 t	Council Regulation (EU) No 72/2016 of 22 January 2016 (3,4)
2017	3762 t	3430 t	Council Regulation (EU) No 2017/127 of 20 January 2017 (3,4)
2018	4314 t	3795 t	Council Regulation (EU) No 2018/120 of 23 January 2018 (3,4)
2019	4759 t	3550 t	Council Regulation (EU) No 2019/124 of 30 January 2019 (3,4)
2020	4759 t	3373 t	Council Regulation (EU) No 2020/123 of 27 January 2020 (3,4)
2021	5129 t	NA	Council Regulation (EU) No 2021/703 of 26 April 2021 (3,4)*

(1) Catches of cuckoo ray (*Leucoraja naevus*) (RJN/89-C), thornback ray (*Raja clavata*) (RJC/89-C) shall be reported separately.

(2) Does not apply to undulate ray (*Raja undulata*), common skate complex (*Dipturus batis* and *D. intermedius*) and white skate (*Rostroraja alba*). Catches of these species may not be retained on board and shall be promptly released unharmed to the extent practicable. Fishers shall be encouraged to develop and use techniques and equipment to facilitate the rapid and safe release of the species.

(3) Catches of cuckoo ray (*Leucoraja naevus*) (RJN/89-C), blonde ray (*Raja brachyura*) (RJH/89-C), and thornback ray (*Raja clavata*) (RJC/89-C) shall be reported separately.

(4) Shall not apply to undulate ray (*Raja undulata*). This species shall not be targeted in the areas covered by this TAC. By-catch of undulate ray in subarea 8 (since 2015) and 9 (since 2016) may only be landed whole or gutted, and provided that it does not comprise more than 20 kilograms live weight per fishing trip in subarea 8 (in 2015 and 2016) and 40 kilograms of live weight per fishing trip in subarea 9 (in 2016). This provision shall not apply for catches subject to the landing obligation. By-catches of undulate ray shall be reported separately under the codes RJU/8-C and RJU/9-C, respectively for each subarea.

*** UK quota not agreed at the time of publication.**

Regarding *R. undulata* no management measures had been adopted by European Commission (EC) until 2009, when EC regulations stated that *Undulate ray … (in) … EC waters of VI, VII, VIII, IX and X … may not be retained on board. Catches of this species shall be promptly released unharmed to the extent practicable* (CEC, 2009). In 2010, *R. undulata* was listed as a prohibited species on quota regulations (Section 6 of CEC, 2010). In 2017, EC stated that *shall be prohibited for third-country vessels to fish for, to retain on board, to tranship or to land the following* undulate ray *whenever they are found in Union waters of ICES subareas VI, IX and X (*Council Regulation (EU) No 2017/127). A bycatch TAC was established for Subarea 8 since 2015 and for Subarea 9 since 2016, under the limits presented in the table below:

Year	TAC for EU waters of Subarea 8	TAC for EU waters of Subarea 9	ICES landing estimates in Subarea 8	ICES landing estimates in Subarea 9	Regulation
2015	25 t	-	16 t	-	Council Regulation (EU) No 523/2015 of 25 March 2015 (3,4)
2016	25 t	40 t	21 t	31 t	Council Regulation (EU) No 72/2016 of 22 January 2016 (3,4)
2017	30 t	48 t	30 t	46 t	Council Regulation (EU) No 2017/127 of 20 January 2017 (3,4)
2018	30 t	48 t	26 t	52 t	Council Regulation (EU) No 2018/120 of 23 January 2018
2019	33 t	50 t	31 t	38 t	Council Regulation (EU) No 2019/124 of 30 January 2019
2020	33 t	50 t	29 t	45 t	Council Regulation (EU) No 2020/123 of 27 January 2020
2021	33 t	50 t	NA	NA	Council Regulation (EU) No 2021/703 of 26 April 2021

For 2021, and under Regulation (EU) No 2021/703 it was stated that the catches shall remain under the quotas as followed:

Raja undulata	2021 Union waters of 8 (RJU/8-C)	2021 Union waters of 9 (RJU/9-C)
Belgium	0	0
France	13	20
Portugal	10	15
Spain	10	15
UK	0*	0*
UE	33	50

*** UK quota not agreed at the time of publication.**

Unwanted catches of skates and rays in subareas 8 and 9 for the period 2019–2021 are regulated by the Commission Delegated Regulation (EU) 2018/2033, reviewed in 2019 (Commission Delegated Regulation (EU) 2019/2237), which establishes the details of the landing obligation in Southern-Western waters. According to this, based on scientific evidences of high survivability, most skates and rays are exempted from the landing obligation. This exemption implies that when discarding skates and rays in the cases referred above, those shall be released immediately, and that during the period 2019–2021, all Member States have to present before 1 May each year additional scientific information supporting the exemption. The Scientific, Technical and Economic Committee for Fisheries shall assess that scientific information by 31 July every year. The exemption applies to:

- All skates and rays (except *L. naevus*) caught by all fishing gears in subareas 8 and 9;
- *L. naevus* caught by trammel nets in subareas 8 and 9;
- *L. naevus* caught by trawls in Subarea 8.

19.2.4.1 Regional management measures

Portugal

The Portuguese Administration adopted, on 29 December 2011, national legislation (Portaria no 315/2011) that *prohibits the catch, the maintenance on board and the landing of any skate species belonging to the Rajidae family, during the month of May along the whole continental Portuguese EEZ*. This applies *to all fishing trips, except bycatch of less than 5% in weight*. The legislation was updated on 21 March 2016 (Portaria no 47/2016) by extending the fishing prohibition period to June.

By 22 August 2014, the Portuguese Administration adopted a national legislation (Portaria no 170/2014) that *establishes a minimum landing size of 52 cm total length (L_T) for all Raja spp. and Leucoraja spp*.

On 19 May 2016, Portugal adopted a legislative framework (Portaria no. 96/2016) regarding the 2016 quota of *Raja undulata* in Division 9.a assigned to Portugal. This framework includes a set of conditions for licensing specific fishing permits to vessels on the owner's request, provided that each vessel fulfils the set of specific conditions which include fishing vessel type, fishing license and historical skate landings. Vessels having the specific fishing permit shall comply with a set of rules, which include obligation to transmit, to both the General Directorate of Natural Resources, Maritime Security and Services (DGRM) and to IPMA, specific fishing data using a form designed by DGRM and IPMA to register haul and catch data on a haul-by-haul basis; the obligation to accept scientific observers duly accredited by IPMA onboard, except in situations where, demonstrably, due to vessel's technical characteristics, it affects the normal activity of the vessel. In 2019, the DGRM introduced a landing control process according to which, in addition to licensed vessels, vessels not possessing the special fishing license were allowed to land a maximum of one specimen per trip and were also obliged to provide additional information on their fishing activity related to *R. undulata* captures.

On each fishing trip, vessels are prohibited from targeting undulate ray and are obliged to land the species under specific conditions: a maximum of 30 kg of undulate ray live weight (for licensed vessels) or one specimen per trip (for non-licensed vessels) is allowed; only whole or gutted specimens can be landed and a minimum (78 cm L_T) and a maximum (97 cm L_T) landing sizes are adopted. During the months of May, June and July of each year the capture, retention onboard and landing of undulate ray is prohibited, but data on catches should be recorded. On 16 January 2017, Portugal updated the 2016 legislative framework regarding the 2017 quota of *Raja undulata* in Division 9.a assigned to Portugal, from 12 to 15 tonnes with no other major differences on the criteria (Portaria no. 27/2017).

France

Based on feedback from scientific programs carried out since 2011 in close partnership with fishermen, it was decided in December 2013 to remove undulate ray from the list of prohibited species, without landings permitted (Total Allowable Catch of zero). In December 2014, thanks to measures proposed by Member States to ensure the sustainable management of local populations of undulate ray, a small TAC has been allowed for France in ICES divisions 7.e-d and 8.a–b, with limited bycatch but no targeted fishing. Since then, the French authorities adopted different decrees to regulate bycatch and landings of undulate ray. Starting in 2016, a legislative framework similar to the one adopted by Portugal was implemented, with landing of undulate ray allowed for a limited number of vessels conditioned by the systematic reporting of catches of this species, a minimum landing size of 78 cm and landing limitations per trip and time period. The obligation of possessing a special permit to land *R. undulata*, which was in place since the dedicated TAC for this species in ICES divisions 8.a and 8.b was set over 0, was lifted in 2019. For more details on the different modalities of this bycatch by year, see Gadenne (2017 WD).

Spain

The Spanish Ministerio de Agricultura, Pesca y Alimentación published in the Resolution of 1 July 2019 the list of species for 2019 that have high survival and that can be released into the sea once captured that affected the stocks of *Raja microcellata* in 7.fg, Rajiformes in 6, 7, 8, 9 and *Raja undulata* in 8.c and 9.

In March 2020, the list of species with exemption of the landing obligation based on high survival was updated (Boletín Oficial Del Estado nº 66, sec. III), following the Commission Delegated Regulation (EU) 2019/2237. The updated list includes all skates and rays (except *L naevus)* caught by all fishing gears in Divisions 8 and 9, *L naevus* caught with trawl in Division 9 and *L naevus* caught with trammel nets in Divisions 8 and 9. The recommendation is to release immediately the unwanted catch of those species below the sea surface.

19.3 Catch data

19.3.1 Landings

Tables 19.1a–e and Figure 19.1 show ICES combined annual landing estimates for all skates, by country.

Table 19.1f gives annual ICES landings by stock and country, and Table 19.2a presents the annual ICES landing estimates, by division for each skate and ray species and in a separate table also landings of Dasyatidae, Myliobatidae, Rhinobatidae, Torpedinidae and Gimnuridae (included in 2020) species (see Section 19.10). Table 19.2b shows the ICES estimates of landings by species and year of the other skates and rays in Subareas 8 and Division 9.a.

Skates in Bay of Biscay and Cantabrian Sea (Subarea 8)

Historically, since 2005 approximately 68% of landings in Subarea 8 were made by France and 31% by Spain (Basque Country included). Since 1973, skate landings show no clear trend, although at the earlier years of the time-series (1973–1974) and in the period from 1982–1991 remarkably high values were registered. From 2005–2019, annual landings were around 1900–3100 tonnes y^{-1}.

In 2020, the divisions with the highest landings were 8.a–b (71%), and these were mostly from France (1043 tonnes). In Division 8.c, landings represented 26% of the total landing of Subarea 8 and were mainly from Spain (450 tonnes). Landings from Division 8.d were only 51 tonnes.

Skates in Division 9.a

In this division, Portuguese and Spanish historical landings since 2005 account for *ca.* 78% and 22%, respectively of reported skate landings. Since 2005, total landings of skates remained relatively stable, at about 1265–1863 tonnes y^{-1}.

From 2005 to 2020, Portuguese mean annual landings were *ca.* 1250 tonnes y^{-1}, with a maximum of 1544 tonnes in 2006 and a minimum of 1012 tonnes in 2015. Spanish mean annual skate landings were *ca.* 345 tonnes, with a maximum of 481 tonnes in 2013 and a minimum of 134 tonnes in 2008.

19.3.2 Discards

Discard information available for Subarea 8 and Division 9.a and country is presented in the Table 19.3.a and included all the stocks in the area for which they have been reported discards.

All the discard estimates presented in this section come from the official data provided by the national DCF programs, and WGEF members consider them reliable data for the advice calculation of some stocks (e.g. rjn.27.8c, rjn.27.9a). However, in the cases in which the historical series are too short or contain significant gaps or missing data (and in most cases also considered negligible) they have been considered not suitable for advice purposes (e.g. rjc.27.8, rjc.27.9a, rjh.27.9a, rjm.27.8, rjm.27.9a).

Although there may be a widespread discarding of skates across fisheries, a proportion of these are likely to survive, particularly in the case of the polyvalent fleets using trammel and gillnets. In these fisheries, discard survivorship varies with soak time.

In WKSHARK3 (ICES, 2017), current sampling programmes for discards were evaluated to examine the suitability for the estimation of discard rates and quantities for the elasmobranch case study considered.

Spain OTB fleet in subareas 8 and 9

The IEO "Spanish Discards Sampling Programme" started in 1988, focused on the Spanish trawl fleets operating in the "Celtic Seas" (ICES subareas 6 and 7) and the "Bay of Biscay and the Iberian coast" (ICES subareas 8 and 9) Ecoregions. However, it did not have annual continuity until 2003, after the Data Collection Regulation (DCR) implementation. According to these data, the most discarded skates by Spanish otter fleet (despite annual variations) are *R. clavata*, followed by *R. montagui* and *L. naevus* (Table 19.3a). Discards from the Basque OTB (Bottom Otter Trawler) fleet in divisions 8.a-b, d indicates that small skate specimens are commonly discarded. *L. naevus* and *R. clavata* are the most discarded species and represent depending on the year 4–53% and 0–52% of the total catches of these species (Table 19.3b).

Portuguese OTB fleet in Division 9.a

Information on discards of elasmobranchs produced by the Portuguese bottom otter trawl fleets (crustacean and demersal fish bottom otter trawlers) operating in Division 9.a has been collected by the DCF Portuguese on-board sampling program since 2003. The routine estimator used to estimate total discards in the Portuguese trawl fisheries does not apply to species with occurrence lower than 30% of the sampled trips, which is the case of all skate and ray species (Serra-Pereira *et al.*, 2017). The low frequency of occurrence registered for skates and rays in Portuguese trawl fisheries indicates that discards from that fleet can be considered negligible for all Iberian skate and ray stocks (Fernandes, 2021). Procedures for estimating the probability of a given species being caught in a haul and of a specimen being discarded, as well as the expected number of discarded specimens per haul, are described in the Stock Annex for each species. The overall discard estimates obtained by species for the two fleets were low.

In 2020, the Portuguese onboard sampling programme was compromised by the pandemic situation due to Covid-19 and the sampling only occurred in the first quarter of the year. For this reason, the sampling effort was not representative of the fishing effort of the Portuguese bottom otter trawl fleets. For the species presenting low frequencies of occurrence in the discards of sampled hauls in the previous sampling period (2016–2019), which is the case of skates and rays, the discards were considered zero or negligible also for 2020 (Fernandes, 2021).

Polyvalent Portuguese fleet in Division 9.a

Discard data for skates were collected during the DCF skate pilot study and the DCF trammel net fishery pilot study targeting anglerfish. The former included fisheries operating in shallow waters (depths < 150 m), whilst the latter examined the fishery operating at depths > 150 m. The frequency of occurrence of rajids was higher in nets operating < 150 m, presumably due to a higher spatial overlap with the species' distributions. For all the skate species, the probability of the species being caught in a haul and a specimen being discarded and the expected number of discarded specimens per haul were low (see Prista *et al.*, 2014 WD and the Stock Annexes for more details).

Under DCF, information on discards from vessels belonging to the polyvalent fleet, particularly those with length overall (LOA) larger than 12 m, using set gillnet and trammel nets to target demersal fish have been collected since 2011, and data were analysed for the period 2011–2014 (Figueiredo *et al.*, 2017 WD). Within the sampled trips (n = 49), seven species of skate were identified in the discards. The main discarded species was *R. clavata,* which occurred in between 13 to 38% of the sampled hauls. The mean proportion in number of *R. clavata* discarded by haul on the sampled trips was between 0.16 and 0.33. Only *R. clavata* had sufficient sampled individuals to analyse the length-frequency distribution of the retained and discarded fractions (Figure 19.2c). However, even for that species the observed length pattern varied between years.

No new information was provided in 2021.

French fleet in Subarea 8

Gill- and trammel net métiers discard a fraction of large fish, which might be considered as damaged fish (e.g. partly scavenged catch). Unlike smaller discarded individuals, a portion of which may survive, these discards are dead discards.

In trawl fisheries, due to the low commercial value of small specimens, the mean size of discarded specimens is much smaller than that of landed specimens. It is likely that some discarded specimens survive.

In 2020, due to the pandemic situation, the opportunities of boarding were reduced for observers. As a consequence, discards could not be estimated for some species that year (e.g. *R. undulata*).

Belgium fleet in subarea 8

Beam trawl reported only discards of *L. naevus* since 2013. Discards amounts are very variable with a minimum of 34 t in 2018 to a maximum of 859 t in 2017. It is worth noting that part of the reported discards may have been caught in subareas 6 and 7.

UK fleet in Subarea 8

UK only reports discard of *L. naevus* ranging from from 33 t to 207 t. Notice that part of the reported discards can belong to the subareas 6 and 7.

19.3.3 Discard survival

WKSHARK3 (ICES, 2017) and WKSHARK 5 (ICES, 2020b) reviewed available studies to identify where there are existing data on at-vessel mortality and post-release mortality of elasmobranch species by area, gear type and identify important data gaps.

Discard survival data available on skates caught in trammel net fisheries (mesh size ≥ 100 mm) in ICES Division 27.9.a, collected under the Portuguese DCF pilot study on skates (2011–2013), and presented in previous reports was re-analyzed and the results summarized in Serra-Pereira and Figueiredo (2019a WD). Experiments were conducted on categorical vitality assessment (CVA) after capture of *R. clavata, L. naevus, R. montagui, R. brachyura* and *R. undulata* and indicate that it is generally high for all species, as the percentage of skates in Excellent and Good vitality status was above 75% for all species, mesh size and soak time considered (Table 19.4a).

- ***R. clavata*** - specimens caught in both mesh size groups with soak time < 24h were mainly found in Excellent condition (100% and 92%, respectively), while those from hauls with > 24h, although most specimens were caught in Excellent condition (72% and

52%), the percentage of Poor/Dead vitality status was comparatively higher (16% and 24%, respectively for each mesh size);

- ***R. brachyura*** - most specimens were caught in Excellent conditions, representing 67% of the observations from mesh size < 180 mm and soaking time < 24h, 92% for the same mesh and soaking time > 24h, 57% and 70% for mesh size > 180 mm for each soaking time period, respectively. The highest percentage of specimens in Poor/Dead status for that species was observed for mesh size > 180 mm and soaking time < 24h (24%);
- ***R. montagui*** - specimens caught with mesh size < 180 mm and in Excellent vitality represented 100% and 67% depending on the soaking time; specimens caught with mesh size > 180 mm and in in Excellent vitality represented 40% and 37%. The percentage of specimens in Poor/Dead conditions was higher for the larger mesh size group (30%) than for the smaller one (0% and 12%);
- ***L. naevus*** - representative data was only obtained for mesh size > 180 mm and soaking time > 24h. Under this situation 58% was the percentage of specimens in Excellent condition while 21% and 21% corresponded to specimens in Good and 21% Poor/Dead condition respectively;
- ***R. undulata*** - the percentage of specimens in Excellent conditions was higher than 79% for all mesh sizes and soak times; highest values observed for mesh size > 180 mm and soaking time > 24h (96%). The percentage of specimens in Poor/Dead conditions was 2% and 5% for mesh size < 180 mm and 3% and 14% for mesh size > 180 mm, respectively for each of the two soaking times considered.

Results suggest that the vitality after capture of a specimen is not related to its size, as for all the species, and regardless of specimens' size (TL < 52 cm and > 52 cm), the majority was found in Excellent vitality condition (60–92%). This indicate that fish below the currently established minimum landing size of 52 cm for all Rajiformes (except *R. undulata*) and 78 cm for *R. undulata* and above the maximum landing size 97 cm for the latter, if released immediately to the water after capture have a potentially high survival capacity.

Additionally, a mark-recapture study (UNDULATA project, 2014–2015) of *R. undulata* caught by trammel nets obtained a return rate of 11% and the mean observed time-at-liberty was of 54 days and maximum of 313 days. These results are a good indication that the species has a potential high long-term survival.

In 2017, an experiment was carried out in the Bay of Bourgneuf (Division 8.a) during which 163 undulate rays were caught using a bottom otter trawl (Morfin *et al.*, 2019). 144 individuals in a good-enough physical condition were equipped with acoustic transmitters and fixed receivers were deployed in the semi-enclosed bay, in addition to occasional tracking with a mobile antenna. The study concluded that a minimum of 49% of the skates survived at least 2 weeks after tagging (with a maximum estimated survival of 97.5% considering at deck mortality). The 49% estimate is a minimal survival rate because it could not be established whether individuals that were not detected after 2 weeks were dead or had wandered outside the detection range of the receivers during the time of the experimentation.

In 2018, new experiments were conducted onboard PTGFS-WIBTS-Q4 and PT-CTS (UWTV (FU 28–29)) surveys to collect CVA and short-term survival estimates (only in the former) for *R. clavata* caught by otter trawl. Overall, most of the specimens were found in Excellent or Good conditions (60–72%), with an at-vessel-mortality of 6–7% (Table 19.4b). All specimens in Excellent vitality status showed tail grab, spiracles and body flex reflexes. The percentage of body flex and tail grab reflexes decreased with vitality status, 71% to 29% and 48% to 29%, respectively. The preliminary estimated survival, based on captivity observations of *R. clavata* during a maximum of 4 days, was 64%.

In 2019, the Project DESCARSEL, conducted by IEO (Spain), performed survivability experiments of cuckoo ray (*L. naevus*) in trawl fisheries operating in northern Portugal fishing grounds (Division 9.a) (Valeiras *et al*., 2019). The study was conducted in April–May 2019 onboard a Spanish commercial trawler and included vitality and captivity observations. From a total of 503 individuals captured, 141 were placed in tanks for survival monitoring. The vitality results showed that 7.6% of the skates (n = 38) were assessed as Excellent condition, 24.1% (n = 121) as Good and 35.2% (n = 177) as Poor, and 33.2% (n = 167) were Dead. Estimated survival at 36h was 27% (21–36%). Maximum survivability at tank captivity was 7 days. Estimated 50% survivability was different for each vitality status. Skates assessed as Poor vitality died in 12 hours after hauling, while those with Excellent vitality lasted 41 hours (1.7 days) and those with Good vitality lasted 24 hours. The low survival estimates obtained from this study resulted on the removal of *L. naevus* caught by trawl in Division 9.a. from the exemption of the landing obligation (BOE, 2020, Nº 66, sec. III).

In 2020, the project SURF studied the survivability of cuckoo ray (*L. naevus*) discarded by French trawlers targeting demersal fish and operating in the Celtic Sea (Division 7h) and northern Bay of Biscay (Division 8a). The sampling, realised on a French commercial trawler, was stratified by vitality class and sampled individuals were landed and their state was monitored during up to three weeks in aquarium facilities in September 2020. Beside this, the vitality status of other discarded individuals was reported by an onboard observer during fishing trips carried out during winter, spring and summer aboard four different trawlers. The final survival rate ranged from 12% to 22% and was mainly influenced by haul duration and weather conditions (wave height).

To note that all the experiments here described followed the procedures described in previous studies on the survival of this group of species and the recommendations made by the STECF and the ICES Working Group on Methods to Estimate Discard Survival.

In early 2021, ICES conducted a workshop on the inclusion of discard survival in stock assessments (WKSURVIVE; ICES, 2021a). It was recognized that this continues to be an active research, particularly in what regards discard survival of skates and rays, due to its link to the EU conditional survivability exemption and associated evidence roadmap. Due to the complexity and specifications across stocks, it was recommended that the task of including discard survival into stock assessments should be driven by stock assessment groups. To avoid the long benchmark process, this group recommended an inter-benchmark meeting to address the inclusion of discard survival across multiple stocks within the same meeting, to accelerate the process.

19.3.4 Quality of the catch composition data

Species composition of landings in Subarea 8 and Division 9.a, corrected according to the WKSHARK2 reporting guidelines (ICES, 2016) are presented (Tables 19.1f and 19.2). In recent years, official landings reported as Rajiformes (indet.) have declined because of the EU mandatory species-specific reporting. In the case of the Portuguese official landings statistics, eight commercial designations were reported in 2017: "raia lenga" (*R. clavata*), "raia pontuada" (*R. brachyura*), "raia manchada" (*R. montagui*), "raia-de-dois-olhos" (*L. naevus*), "raia de S. Pedro" (*L. circularis*), "raia-zimbreira" (*R. microocellata*), "raia-de-quatro-olhos" (*R. miraletus*) and "raia bicuda" (*D. oxyrinchus*).

Landing misidentifications and/or coding errors still occur in Subarea 8 and Division 9.a. To address this, IPMA developed statistical procedures to better estimate species-specific landings during the DCF skate pilot study (2011–2013) (Figueiredo *et al*., 2020c). Table 19.5 gives updated landing proportions for each skate species (see Stock Annex for more details on the method). After this study, DCF sampling effort for skates decreased, and the precision of the estimates has decreased accordingly. An increment in sampling effort is recommended, ideally included in the

Portuguese DCF program. Since 2017, a dedicated sampling programme on skate and ray species composition, incorporated in the DCF, was implemented in the main landing ports (Matosinhos, Póvoa do Varzim, Peniche, Sesimbra and Setubal). Within this, extra samples are being collected with the objective of collecting more information on the comparison of market labels and the species being landed. These samples are combined with those from the DCF concurrent sampling and used to estimate the Portuguese species-specific landings using the statistical procedure mentioned above.

A similar pilot-study in the same period (2011–2013) was implemented by AZTI in Division 8.c. The main objective of the Basque Country pilot study was to characterize the main fishing parameters of the trammel net fishery (fishing gear, métier, effort and LPUE) and to identify the skate species present in the landings, as well as biometric relationships such as "wing weight/total weight" and "total length/wing width", to better estimate the live weight of the landed skates.

In France, it is requested that all landings be recorded at species level. The quality of species reporting has improved in the last decade. Although auction markets now use identification guides and record sales accordingly, some misidentification is still likely to occur. Since 2012, a dedicated program "Elasmobranch on Shore" aims to collect data on mislabelling in the main French auctions. Since 2018, the survey targets two auctions being considered as the most relevant in terms of landings for the Bay of Biscay. Each auction is visited every month and each selling name is sampled from all landing vessel in order to determine the level of mislabelling into those auctions (Mayot and Barreau, 2021). Generic selling names such as *Raja spp.* Have been less used since 2014 but elasmobranch species are still mislabelled or mixed with other species such as teleosts. Fleets frequenting those auctions are mainly small units going at sea for one to three days so quantity landed per unit can be low and mislabelling often considered as minor and need to be analysed together. Due to the complexity and diversity of the mislabelling, ongoing work is done to be able to correct efficiently the landing data in this area in years to come.

19.4 Commercial catch composition and length frequency distribution

Subarea 8

Length–frequency distributions of the retained and discarded catches of *R. clavata, L. naevus*, *R. montagui and R. undulata* from Basque (Bottom Otter Trawl) and French fleets (bottom trawl and nets) are presented (figures 19.2a-b).

In the Basque Bottom trawl *L. naevus* and *R. clavat*a are discarded in all size range and only the individuals larger than 30–35 cm are retained.

In the French fleets, only the individuals of *R. clavata* larger than 50 cm are retained, while larger individuals of *R. undulata* are landed (the species has a minimum conservation reference size of 78 cm TL). Some individuals of *L. naevus* below 50 cm TL are sometimes retained as well. For *R. montagui*, the length distribution of discarded individuals cannot be estimated.

Division 9.a

Length–frequency distributions of *R. clavata, R. montagui, L. naevus* and *R. microocellata* from the Portuguese commercial polyvalent and trawl fleets for the period 2008–2020 are presented in figures 19.2d–g. Length–frequency distributions were extrapolated to the total estimated landed weight of each species. Within each fleet, length distributions and their ranges were similar between years. However, for some species, there were differences in length distributions between the polyvalent and trawl fleets. Note that for *R. microocellata* the length–frequency distribution is only presented for the polyvalent fleet, due to the low occurrence of this species in landings from the trawl fleet.

Length data on *R. brachyura* are available from four different sampling sources that resulted from different research programs which have in common the same sampling strategy for collecting length data. The density plots of length by sampling source and fishing segment are presented in Figure 19.2h. In the early years of the time series the sampling effort was reduced and the corresponding length frequency distributions for the exploited population reflect that and should be analysed with caution.

19.5 Commercial catch–effort data

19.5.1 Spanish data for Subarea 8

An updated nominal LPUE-series for the Basque Country's OTB DEF>=70 and OTB DEF=100 in Subarea 8 from 2001–2019 presented in 2020 was not updated (Table 19.6; Figure 19.3).

19.5.2 Portuguese data for Division 9.

19.5.2.1 Effort data

In the Portuguese continental coast, Rajidae species are mainly landed by the polyvalent segment followed by trawl. In 2019, the landed weight of Rajidae derived from the polyvalent segment represented 82% of the total landings. This fishing segment is characterized by multi-species and mixed fisheries and includes vessels with length overall (LOA) ranging from 5 to 27 m, which generally operate between 10 to 150 m deep (but can fish down to 600 m deep). The analysis of DCF sampling data indicates that Rajidae are mainly caught by trammel nets, which is considered to be the most appropriated gear to catch these species.

Annual landings by species are calculated using the official daily landings data set and market sampling data collected under DCF according to the procedure described in stock annexes and in Figueiredo *et al.* (2020c).

Fishing effort time series (2008–2020) for each fleet segment, polyvalent and trawl, were analysed. Consistently increasing or decreasing trends (monotonic) on the fishing effort data collected over time were investigated and the non-parametric Mann-Kendall trend test was applied (https://cran.r-project.org/web/packages/Kendall/Kendall.pdf). For each fishing segment, the test was applied to the last 10 years of the fishing effort series, considering the number of fishing trips with landings of Rajidae species as sampling unit. The fishing effort time series for each fishing segment is presented in the following table:

Year	No Fishing trips	
	Polyvalent	Trawl
2008	36149	6513
2009	36239	5683
2010	34767	5461
2011	36761	5139
2012	32565	5158
2013	28007	4658
2014	25779	4471
2015	25723	4325
2016	24476	4593
2017	25296	4237
2018	24761	4566
2019	24561	4492
2020	27464	4650

For the polyvalent segment, the plot of the fishing effort time series with lowess smooth suggests a downward trend and the autocorrelation in this data series does not appear significant (Figure 19.4.a), which is confirmed by the results of the Mann-Kendall trend test applied to the last 10 years of the fishing effort series for this fleet (tau = -0.6, p-value = 0.02).

As observed for the polyvalent fleet, the fishing effort time series plot with lowess smooth for the trawl segment, suggests a downward trend (Figure 19.4.b). Yet, when considering the last 10 years of the time series for this fleet the Mann-Kendall trend test is not significant, indicating that there is no trend in the data, and can be therefore considered stable (tau = -0.33; p-value = 0.21). The autocorrelation for the same period does not appear significant (Figure 19.4.b). The overall decrease in fishing effort observed for both fleets may be related to several factors including the inclusion of *R. undulata* in the prohibited species list in 2009, the implementation of seasonal closures since 2012, and changes in the target species in some polyvalent fleets.

19.5.2.2 CPUE and Effort data

Standardized LPUE (kg trip^{-1}) time-series (2008–2013) for the most representative skate species (*R. clavata, R. montagui, R. brachyura, L. naevus* and *R. undulata)* were determined based on fishery data collected under the DCF skate pilot study on skates in Division 9.a. Standardized LPUE indices for *L. naevus* were calculated for both the polyvalent and trawl fleets (the two fleets each contribute *ca.* 50% each of the annual landings). For the remaining species, standardized LPUE indices were only calculated for the polyvalent fleet. Methodological procedures to calculate standardized LPUE are described in the Stock Annex for rjh.27.9a.

In 2021, standardized LPUE was updated for *R. brachyura* (see Section 19.9.11 for more details) *R. montagui* (see Section 19.9.7 for more details), *Raja clavata* (see Section 19.9.2 for more details) and *Leucoraja naevus* (see Section 19.9.5 for more details) in Division 9.a.

For *R. undulata* a CPUE time-series is being developed through the adjustment of a zero-truncated poisson regression model using fishery dependent data collected since 2016 (see Section 19.9.10 for more details on perliminar results).

19.5.3 Quality of the catch-effort data

Under the 2011–2013 DCF pilot study on skates developed by IPMA in Division 9.a, the quality of catch and effort data by species has improved greatly. It is recommended that catch-effort data by species continue to be collected, and focused sampling effort be undertaken for more coastal species.

19.6 Fishery-independent surveys

Groundfish surveys provide data on the spatial and temporal patterns in species composition, size composition, relative abundance and biomass for various skates. The fishery-independent surveys operating in the Bay of Biscay and Iberian Waters are discussed briefly below (see Stock Annex for further details).

Due to the patchy (mainly coastal) distribution and habitat specificity of some skate species (e.g. *R. undulata, R. brachyura* and *R. microocellata*), existing surveys do not provide reliable information on abundance and biomass. In order to gather information on the distribution and spatio-temporal dynamics, and on abundance and biomass for those species, WGEF recommends dedicated surveys using an appropriate fishing gear be developed in this ecoregion.

19.6.1 French EVHOE survey (Subarea 8)

The EVHOE-WIBTS-Q4 survey has been conducted annually in the Bay of Biscay since 1987 (excluding 1993, 1996 and 2017). The survey is usually conducted in October and November (but was undertaken from mid-September to end-October in 1989, 1990, 1992 and 1994, and in May during 1991). In 1988, two surveys were conducted, one in May the other in October. Since 1997, the main objectives have been: i) the construction of time-series of abundance indices for all commercial species in the Bay of Biscay and the Celtic Sea with an emphasis on the yearly assessed species where abundance indices at-age are computed; ii) to describe the spatial distribution of the species and to study their inter-annual variations; and iii) to estimate and/or update biological parameters (e.g. growth, sexual maturity, sex ratio).

Population indices from the French EVHOE-WIBTS-Q4 survey were calculated for all elasmobranchs caught. For skates and rays, indices of abundance and biomass per year are only considered reliable for *L. naevus* and *R. clavata* only. For other species, the small numbers commonly taken (except in some few occasional hauls with high catches) do not allow reliable estimates.

19.6.2 Spanish survey data (divisions 8.c and 9.a)

The Spanish IEO Q4-IBTS annual survey in the Cantabrian Sea and Galician waters (divisions 8.c and 9.a) has covered this area since 1983 (except in 1987), obtaining abundance indices and length distributions for the main commercial teleosts and elasmobranchs. The survey has a stratified random sampling design, with the number of hauls allocated proportionally to the area of each stratum. Results for elasmobranch species sampled in the IEO Q4-IBTS survey on the Northern Iberian shelf (Division 8.c and northern part of 9.a) were presented by Fernández-Zapico *et al*. (WD04 – 2021). Depth stratification ranges from 70–500 m, therefore, catch rates of shallower species, such as *R. undulata*, are low and cannot be used to estimate abundance or biomass indices. More information on this survey is given in the Stock Annex and WKSKATE report (ICES, 2021c).

The Spanish bottom trawl survey IBTS-GC-Q1-Q4 (ARSA) in the Gulf of Cadiz (Division 9.a) has been carried out in spring since 1993 and in autumn since 1997 up to date 2020. Despite COVID-

19 issues both surveys were conducted in 2020. The surveyed area corresponds to the continental shelf and upper-middle slope (depths of 15–800 m) and from longitude 6º20'W to 7º20'W, covering an area of 7224 km^2.

19.6.3 Portuguese survey data (Division 9.a)

The Portuguese Autumn Groundfish Survey (PtGFS-WIBTS-Q4) is conducted by IPMA (Cardador *et al*., 1997). *R. clavata* is the most frequent skate species caught (88% of the total weight of skates). For most of the time series the PtGFS-WIBTS-Q4 was conducted onboard the R/V *Noruega* and used a Norwegian Campelen Trawl (NCT) gear with rollers in the groundrope, and 20 mm codend mesh size (ICES, 2015a). In 1996, 1999, 2003 and 2004 the R/V *Noruega* was unavailable, and the surveys were conducted by the RV *Capricórnio*, using a FGAV019 bottom trawl net, with a 20 mm cod-end mesh size and a ground rope without rollers. In 2012, no vessel was available to conduct the survey. In 2018, due to mechanical problems in R/V *Noruega*, part of the PtGFS-WIBTS-Q4 survey (i.e. 12 stations) was conducted onboard the commercial trawler *Calypso* (Dimensions = 24.8 m * 7.8 m, Ton = 215 tonnes), using a FGAV019 bottom trawl net, with a 20 mm codend mesh size and a ground rope without rollers, which covered the Alentejo coast (strata LIS, SIN, MIL and ARR) (Serra-Pereira and Figueiredo, 2019b WD). Those years in which the PtGFS-WIBTS-Q4 survey was conducted with a different vessel and gear were excluded from abundance and biomass analyses (Figueiredo and Serra-Pereira, 2013 WD; Serra-Pereira and Figueiredo, 2019b WD).

The Portuguese crustacean trawl survey/*Nephrops* Survey Offshore Portugal (NepS (FU 28–29)) is conducted on R/V *Noruega* and uses a FGAV020 bottom trawl with 20 mm codend mesh size. No vessel was available to conduct this survey in 2004, 2010, 2012, and in 2019 (ICES, 2012).

In 2018, PtGFS-WIBTS-Q4 had technical problems, and part of the stations were sampled using a commercial trawler and a different fishing net (using FGAV019 instead of NCT). This had negative effects particularly on the catch of *R. montagui* from Division 9.a (rjm.27.9.a), for which no biomass/index could be obtained (see Section 19.9.7 for more details).

In 2019, both PtGFS-WIBTS-Q4 and NepS (FU 28–29) were not conducted due to issues external to IPMA. In 2020, PtGFS-WIBTS-Q4 was carried out in the new RV "Mário Ruivo" (Dimensions = 75.6 m * 15 m, Ton = 2290 tonnes) and only 6% of the planned number of fishing hauls was achieved; this was due to a combination of legal/logistic constraints and COVID-19 pandemic that largely delayed the start of the survey until the end of the official time period (4th quarter) and year. NepS (FU 28–29) was not conducted, not due to the CoVid-19 pandemic, but to legal constraints of national scope that turned unfeasible the hiring of fishing and vessel crew on time to undertake the survey. The two surveys are planned to be conducted in 2021 with the RV "Mário Ruivo". Due to the use of a new survey and different gear on the PtGFS-WIBTS-Q4 the continuation of the time series of both surveys in the future is uncertain and needs further investigation.

19.6.4 Temporal trends

French EVHOE-WIBTS-Q4 Survey (Subarea 8)

The biomass index of *L. naevus* shows an increasing overall increasing trend since 2000 (Figure 19.5a). *L. naevus* is distributed mainly in the northern area (Division 8.a) of the Bay of Biscay near the continental slope.

R. clavata showed no clear temporal trend over the time series within general index values lower than 10 with an important peak in 2001 (but with a wide confidence interval, Figure 19.5b). *R* *clavata* is commonly caught in certain fishing hauls. It is distributed mainly in the northern and central areas of the Bay of Biscay, from coastal waters to the upper continental slope.

R. brachyura is always found near the coast but was recorded only in a few hauls in the north of Division 8.a. This species was not caught between 1991 and 2010.

R. undulata occurs only in a few shallow hauls close to the coast. Its distribution goes from the northern parts of Division 8.a to the southern parts of Division 8.b. *R. undulata* was not caught in numerous years before 2018.

Spanish IEO Q4-IBTS survey (Divisions 8.c and 9.a)

In 2020, of the five main elasmobranch catches per haul three were skates: *Raja clavata (10%), R. montagui (4%)* and *Leucoraja naevus (1.8%)* (WD04 - Fernández-Zapico *et al*., 2021). In 2020, the biomass of *R. clavata* slightly decreased, *L. naevus* remained similar to the previous year, whereas the biomass of *R. montagui* decreased again in 2020 though still maintaining the medium-high values of the time series. As in previous years, only a few specimens of *L. circularis and R. undulata* were caught. Besides some individuals of the species *R. brachyura, Torpedo marmorata, Tetronarce nobiliana* and *Dipturus oxyrinchus* and Raja sp. were also caught in 2020. On the contrary other occasional species such as *Neoraja iberica, D. nidarosiensis* and *R. microocellata* were not caught this year.

R. clavata: The biomass of the most abundant ray in the area, *R. clavata*, slightly decreased in both divisions in 2020. Even so, it remained between the medium-high values of the time series (Figure 19.6a). In Division 9.a, *R. clavata* is historically scarcer than in 8.c, however the mean biomass of the last two years was quite higher than the previous five years in 9.a and slightly lower in 8.c (Figure 35). The geographical distribution of *R. clavata* remained similar to the previous year, with greater abundance in the North of Galicia and also in the eastern Cantabrian Sea (Figure 19.6b). Sizes ranged from 13 to 102 cm in 2020, with a higher proportion of specimens from 13 to 51 cm, compared to the whole series (Figure 19.6c).

R. montagui: The biomass of *R. montagui* is lower than that of *R. clavata* and declined again in 2020 after a peak in 2018 but remains at a high level compared to the whole time-series. The mean biomass of the last two years was slightly below the mean value for the previous five (Figure 19.7a). In 2020, the spatial distribution was similar to the previous year (Figure 19.7b) and the length distribution ranged from 23 to 74 cm, showing a slightly higher abundance of medium size (40-55cm) individuals compared to the long-term average length distribution and absence of the smallest and largest individuals (Figure 19.7c).

L. naevus: In 2020, the biomass of *L. naevus* remained similar to the previous year, very stable and at high level since 2018. The mean biomass of the last two years was well above than the previous five years (Figure 19.8a). *L. naevus* was absent in Division 9.a and widespread in 8.c as usual. The large spot of biomass found in the Cantabrian Sea between 6º and 7º W longitude since 2018 was present again in 2020 (Figure 19.8b). The length distribution remained similar to previous years, it ranged from 29 to 66 cm, with a highest proportion of individuals around 60 cm (Figure 19.8c).

Portuguese surveys (Division 9.a)

Raja clavata (13–110 cm L_T) is found along the whole Portuguese coast, from 23 to 751 m depths, but is more common south of Cabo Carvoeiro and in waters shallower than 200 m (Figure 19.9a). Biomass and abundance indices have been relatively stable from 1990 to 2014 and then increased since 2015 (Figure 19.9b). The values in 2017 and 2018 were the highest in the time series. The mean annual biomass index for 2017–2018 (0.60 kg h^{-1}) was 56% greater than observed in the preceding five years (2012–2016; 0.39 kg h^{-1}). The mean annual abundance index for 2017–2018 (1.68 ind. h^{-1}) was 103% greater than observed in the preceding five years (2012–2016; 0.83 ind h^{-}

^{1}). The length-distribution was relatively stable along the time series, with the mean length above average in 2017 and 2018 (Figure 19.9c).

Leucoraja naevus (14–65 cm L_T) is found along the whole Portuguese coast, from 55 to 728 m deep, but is more common south of Cabo Espichel and in waters shallower than 500 m (Figure 19.10a). Biomass and abundance indices have been variable in the last seven years, with 2014–2015 showing a slight increasing trend within the average values for the time-series (Figure 19.10b). No *L. naevus* were caught in the 2016. In 2017, the species was only caught in one station. The observed lower catches of *L. naevus* do not follow the increasing trend observed in the Spanish IBTS-GC-Q1-Q4 (ARSA) bottom trawl survey in the Gulf of Cadiz. No technical reason was found for the low catchability observed for the species in the last two years, apart from the later timing of the survey conducted in 2017, July/August instead of May/June (C. Chaves *pers. com.*). Mean annual biomass index for 2017–2018 (0.08 kg h^{-1}) was 12% smaller than observed in the preceding five years (2012–2016; 0.09 kg h^{-1}). Mean annual abundance index for 2017–2018 (0.44 ind h^{-1}) was 46% higher than observed in the preceding five years (2012–2016; 0.30 ind h^{-1}). The length-distribution has been variable during the time series, mainly due to higher catches of juveniles in certain years (Figure 19.10c).

Raja montagui (21–71 cm L_T) is found along the whole Portuguese coast, from 21 to 455 m depths, but more common off the southwest coast of Portugal, at depths of 40–150 m (Figure 19.11a). In 2018, the species was only caught by the commercial trawler used to do additional stations in the southwest coast. Therefore, the estimated survey index, considering only the stations from R/V *Noruega*, was 0 (Serra-Pereira and Figueiredo, 2019b WD). Biomass and abundance indices have been stable since 2014, and above the average values for the time-series (Figure 19.11b). Mean annual biomass index for 2017–2018 (0.09 kg h^{-1}) was 52% smaller than observed in the preceding five years (2012–2016; 0.18 kg h^{-1}). The mean annual abundance index for 2017–2018 (0.25 ind h^{-1}) was 40% smaller than observed in the preceding five years (2012–2016; 0.41 ind h^{-1}). The length-distribution has been relatively stable along the time-series, with the mean length above the average in 2016 and slightly below the average in 2017 (Figure 19.11c).

Spanish IBTS-GC-Q1-Q4 (ARSA) bottom trawl survey in the Gulf of Cadiz (Division 9a South)

In the ARSA time series survey (1993–2020), the most abundant skates are *L. naevus* and *R. clavata.* In 2020, the biomass of *R. clavata* decreased compared to 2019, particularly in the autumn survey however it remains amongst the high values of the time series. In the case of *L. naevus* the biomass index sharply decreased in the last two years 2019 and 2020 in both surveys (Figure 19.12a).

Both species showed an increasing trend in biomass since 1997, with the highest values reached in 2013, 2015, 2018 and 2019, although since 2013 the biomass shows large year-to-year variations. The values in 2020 decreased slightly for *R. clavata* remaining close to 2.0 kg haul whereas *L. naevus* shows a decreasing trend since 2018 remaining at very low values of the time series (0.34 kg haul) (Figure 19.12b).

Despite being variable, abundance indices (nº ind per haul) of *R. clavata* and *L. naevus* show an increasing trend over the time series since 1997. The highest abundance value of *R. clavata* were recorded in the autumn 2013 and 2015 but has slightly decreased in the last 3 years (2018–2020). The abundance of *L. naevus* after the peak in 2017 has strongly decreased in 2019–2020 to the lowest values of the time series (Figure 19.12c).

19.7 Life history information

Available biological parameters of the main species from Portuguese Iberian waters are shown in table 19.7.

Data on the life-history traits of *R. undulata* in the Bay of Biscay are also available (Stéphan *et al.*, 2014a). The length of first maturity was estimated to be 81.2 cm for males (n = 832) and 83.8 cm for females (n = 94). Exploratory growth analyses based on increase in size between tagging and recapture of a small number of tagged *R. undulata* for which size-at-recapture was recorded were consistent with growth estimates for the species in Portuguese waters. More information including diet and a trophodynamic model for the northern part of Division 9.a is available in the Stock Annex.

19.7.1 Ecologically important habitats

Recent studies have provided information on ecologically important habitats for *R. clavata*, *R. brachyura*, *R. montagui*, *R. microocellata*, *R. undulata* and *L. naevus* in Portuguese continental waters (Serra-Pereira *et al.*, 2014). Sites with similar geomorphology were associated with the occurrence of juveniles and/or adults of the same group of species. For example, adult *R. clavata* occurred mainly in sites deeper than 100 m with soft sediment. Those were also considered to be habitat for egg-laying of this species. *Raja undulata* and *R. microocellata* occurred preferentially on sand or gravel habitats. Potential nursery areas for *R. brachyura*, *R. montagui* and *R. clavata* were found in coastal areas with rock and sand substrates. Further details are given in the Stock Annexes.

Information from trawl surveys on catches of (viable) skate egg-cases is considered valuable to further identify ecologically important habitats. Further information could be collected in trawl surveys.

19.8 Exploratory assessments

Previous analyses of the skates in this ecoregion were based on commercial LPUE data and on survey data. Updated analyses were conducted (see below).

19.8.1 *Raja clavata* in the Bay of Biscay

A Bayesian production model was fitted to total catch in divisions 8.a-b and 8.d and EVHOE survey biomass indices (Marandel *et al.*, 2016; ICES, 2020a).

19.8.1.1 Exploratory length-based indicators

A sample of thornback ray landed from fisheries in the Bay of Biscay was measured as part of a French project aiming at a close-kin estimation of the abundance of the stock (http://www.asso-apecs.org/-GenoPopTaille-.html). This length distribution was used in 2018 to fit the LBI and LBSPR (ICES, 2018).

19.8.2 *Raja undulata* in Divisions 8.a-b

An exploratory assessment based on a mark-recapture approach using data from two project (RAIEBECA and RECOAM) collected from 2011 to mid-2014 in the Bay of Biscay contributed greatly to knowledge of the spatial distribution, movements and biology of *R. undulata* (see ICES

(2020) for a full account). An explanatory assessment using length-based indicators was performed for years 2016–2017 and 2018–2019 based on data collected by the onboard observation programme (DCF programme) on French fishing vessels in divisions 8.a-b (Baulier, 2020 WD). The assessment used the eight indicator ratios recommended by WKLIFE (ICES, 2015b) and combined catch data from bottom trawls and trammel nets raised to the corresponding fleets. The reference indicator ratio $L_{mean}/L_{F=M}$ (mean length of individuals larger than the length at first capture over the theoretical average length resulting from exploitation with a fishing mortality equal to natural mortality, which is a proxy for F_{MSY}) suggested that the stock was exploited with a fishing mortality lower than F_{MSY}. However, due to deviations from assumptions necessary to the derivation of reference points (especially steady state and knife-edge selectivity), the actual difference between current fishing mortality and F_{MSY} could not be estimated. Nevertheless, this diagnosis appeared to be robust to the values survival rate of discards applied, the degree of smoothing of the length distribution and the time period considered (2016–2017 or 2018–2019).

19.9 Stock assessment

Given the limited time range of species-specific landing data, and that commercial and biological data are often limited, the status of most skate stocks in this ecoregion is based primarily on survey data, following the Category 3 of the ICES approach to data-limited stocks. Further analyses of survey data (see Section 19.6) and catch rates were undertaken. Due to the absence of survey data for some of the species in this ecoregion (e.g. rjh.27.9a, rju.27.9a, rjm.27.9a), other approaches were adopted for the advice (e.g. LPUE or self-sampling data).

In this section, data and analyses are summarized by stock units for which ICES provides advice.

Assessments are carried biennially and were not fully updated in 2020.

19.9.1 Thornback ray (*Raja clavata*) in Subarea 8 (Bay of Biscay and Cantabrian Sea) (rjc.27.8)

The advice for 2021–2022 was recalculated starting from the advised landings for 2015–2016. The combined index of the two surveys indicates that the stock size indicator has been stable over the longer time series. In the Spanish IEO Q4-IBTS survey the biomass of the most abundant ray in the area, *Raja clavata,* showed a decrease in 2018.

The analysis of French on-board observations shows that *R. clavata* is caught in a significant proportion of hauls only by the OTT_DEF métier, which operates mainly offshore in the Bay of Biscay. For this métier, the indicator suggested an increasing trend since 2007 (Figure 19.13a). The occurrence in other métier is lower and does not show clear signal. For this stock, however, onboard observations may not sample effectively some of the coastal sites of local abundance that occur in some bays and estuaries, such as the Gironde.

Marandel *et al*. (2016) developed a Bayesian state-space model with landings and limited survey (EVHOE-WIBTS-Q4) data to estimate population biomass in the Bay of Biscay. This exploratory assessment concluded that the estimated biomass of *R. clavata* in 2014 was *ca.* 3% of carrying capacity. However, this conclusion should be made carefully because indices of abundance and biomass per year from the EVHOE-WIBTS-Q4 survey can be highly variable for *R. clavata*, so may not be robust, and there is also uncertainty in the longer time-series of landings data.

A larger sample of tissue (fin clips) of landed thornback ray was collected in the Ifremer GenoPopTaille project, funded by the National Agency for Research (ANR). The length distribution of this sample was considered representative of landings from divisions 8.ab and 8.d and used for exploratory length-based indicators (LBI and LBSPR). The length-distribution in this sample was not compared to data from Division 8.c.

19.9.2 Thornback ray (*Raja clavata*) in Division 9.a (west of Galicia, Portugal, and Gulf of Cadiz) (rjc.27.9a)

19.9.2.1 Assessment carried out in 2020

The status of this stock is evaluated based on survey data derived from the Portuguese Autumn Groundfish Surveys (PtGFS-WIBTS-Q4; Figure 19.9b) and the Spanish ARSA survey in Gulf of Cadiz (SpGFS-GC-WIBTS-Q1 and SpGFS-GC-WIBTS-Q4; Figure 19.12a and 19.12b). The biomass index from the PtGFS-WIBTS-Q4 was stable over the overall series. The PtGFS-WIBTS-Q4 was not conducted in 2012 and 2019. Both ARSA surveys series indicate a long-term increasing trend (from 1997–2017 and 2018 with a stable biomass status since the spring 2017).

Combined survey data suggest an increasing trend since 1997 with maximum values observed in the most recent years of the series. Following the ICES DLS approach for Category 3 stocks, the annual trend on the combined surveys (each survey scaled to their average for the overall period) has increased consistently for the overall period.

The ratio between the average biomass index for the last two years (2018–2019) and the average of the biomass index for the reference period (2013–2017) was 1.32.

Auxiliary information provided by the Spanish IEO Q4-IBTS survey in 9.a North, where *Raja clavata* is the most abundant ray caught in the area, also showed an increasing trend in the biomass. Due to the irregular catches of *R. clavata,* this survey is not used in the assessment.

Discard data although included in the previous advice, was not included in 2020, as they are incomplete, since only Spanish data is available but considered negligible (only representing 1–2% of the total catch for the stock).

19.9.2.2 Exploratory LPUE

An alternative assessment approach for this stock using a standardized commercial LPUE series was presented in the WKSKATE meeting (Serra-Pereira *et al.*, 2020 WD; ICES, 2021b), as a consequence of the data availability issues with the PtGFS-WIBTS-Q4 survey in 2018–2020. The method; also applied to other Iberian stocks, is already used for advice on rjh.27.9a and is described in the stock annex for this stock. In brief, it considers the estimated landed weight of the species per trip (fishing effort unit) from the polyvalent fleet using nets, which represents around 80% of the total landings for the stock. To note that the thornback ray and other skate species are a by-catch of such fisheries, generally targeting other and more valuable species (e.g., sole, seabass, anglerfishes, etc.). The landed weight per trip is obtained applying the stepwise statistical methodology described in Figueiredo *et al.* (2020c), in which the vessels are stratified by size and fishing seasonality. Vessels classified in the same *strata* are known to operate similarly in terms of fishing time, size of gear and fishing areas (e.g., smaller vessels tend to operate closer to shore than bigger vessels). The fishing areas exploited by the polyvalent fleet in 9.a have not changed over years and survey data suggest no alterations of the distribution area of the species. So that, it is unlikely that LPUE are not reflecting the biomass in the exploited areas. The fishing trip was adopted as the effort unit because most of the vessels from the polyvalent fleet do not have logbook. The inclusion of variables in the model that inform on the stratification of the fleet allows to have homogenous vessel strata with similar fishing operations. Also, from information collected through inquiries to the Portuguese fleet, the duration of fishing trips from most vessels is around 24h which is equivalent to using the “trip” as fishing effort unit.

Several explanatory variables were investigated as potential candidates and the best model was selected using graphical analysis of residuals and AIC. Those included in the best GLM model (explained variance = 0.80, AIC = 651 723) were: year, quarter, landing port, vessel size, fishing seasonality on skates and rays and fishing gear (trammel nets or gillnets) (Figure 19.4c). Annual standardized estimates of LPUE and the corresponding standard error were calculated for a reference condition of the variables included in the model apart from the year level. For comparison purposes with the current assessment methodology, the LPUE data series was normalized to the long-term mean and compared with the normalized biomass Index obtained from the PtGFS-WIBTS-Q4 survey (Figure 19.4d). In general, both time-series followed similar increasing trends since 2008, and LPUE estimates are within the range of the CI.

So, in order to include the new LPUE series as basis to provide advice for rjc.27.9a in 2022 in the absence of the PtGFS-WIBTS-Q4 survey, the method was presented (Serra-Pereira *et al.*, 2020 WD) and evaluated during WKSKATE and peer-reviewed by an external review group, as a recommendation from ICES ACOM (ICES, 2021b). In brief, WKSKATE acknowledged the adequacy of the Portuguese commercial LPUE series to assess the status of this stock and accepted its use for the next advice, due in 2022; the reviewers also recognized the choice made by the group to look at the use of LPUEs as an alternative to surveys and made suggestions for further improvement. Some of those include the use of more appropriate residual analyses based on the Gamma distribution and comparison with the survey series using the same season (Q4) as a reference level. The main concern from the reviewers about the methodology proposed was the non-inclusion of the zeroes in the analysis. The justification for this approach relies on the fact that the thornback ray is a by-catch species for the polyvalent fishery and has a patchy distribution. Therefore, the absence of the species in the catch is more related to the fishing strategy of the fleet than to the species' abundance. Considering the zeroes along with the positive landings of the species in the LPUE analyses could lead to further uncertainty in the results, as the absence of a species in landings can be a consequence of fishing outside its distributional area and not a consequence of decrease in abundance. Additional analysis of the effect of zeroes in the model will be presented in 2022.

In 2021, the model was updated (explained variance = 0.81, AIC = 699 381) (Figure 19.4d). The best model selected with the updated dataset included all the variables mentioned for the previous model. The mean annual biomass index (kg/trip) scaled by the overall mean for 2019–2020 was 12% greater than the observed in the preceding five years.

19.9.2.3 Exploratory length-based indicators

The LBI indicators for rjc27.9.a caught by the Portuguese polyvalent fleet, which represents around 80% of total landings in Portugal, are presented in Table 19.8a (considering 5 cm length classes). These results were expected as threshold levels are considered inappropriate for elasmobranchs. As discussed in WGEF 2020, the most reliable indicator is the MSY related indicator (L_{mean}/LF=M) which suggest that the rjc.27.9.a stock is exploited at sustainable levels. Despite being below the threshold adopted (WKLIFE V), the values in 2018 and 2019 are very close to 1.

19.9.3 Cuckoo ray (*Leucoraja naevus*) in subareas 6-7 (Celtic Sea and West of Scotland) and divisions 8.a-b,d (Bay of Biscay) (rnj.27.678abd)

This stock is addressed in Section 18, Skates and rays in the Celtic Seas

19.9.4 Cuckoo ray (*Leucoraja naevus*) in Division 8.c (Cantabrian sea) (rjn.27.8.c)

The status of this stock in Division 8.c is evaluated based on survey data from the Spanish (IEO) survey in the North of Spain (SP-NGFS-Q4-IBTS). In 2019, the catch rate in this survey was similar to the previous year (0.63 kg haul^{-1}), remaining among the highest values of the time series (Figure 19.8a). The ratio between the mean biomass index of the last two years was well above the previous five years resulting in 1.26 (Figure 19.8a). Regarding its geographical distribution in the area *L. naevus* was absent in the 9.a Division and widespread in the 8.c as usual. The large spot of biomass found in the Cantabrian Sea between 6º and 7º W longitude the previous year is present again in 2019 (Figure 19.8b). Cuckoo ray length-distribution in 2019 remained similar to the last decade (Figure 19.8c).

Based on this survey indicator a predicted advice for 2021 and 2022 was given. However, this year the advice was given as catch advice instead of landings advice which was done in previous assessments (issue 2018). This is due to the ADG recommendation of including discard data when this information is available and reliable. Data on discards were available for this stock since 2015 and although variable, it is considered reliable and thus has been included in the assessments. For this reason, there has been a shift from landings to catch advice in this stock. Previous landings advice for 2019 and 2020 was 26 t. This year the recommended catch advice for 2021 and 2022 is 42 t which correspond to landings advice of 31 t.

19.9.4.1 Exploratory length-based indicators

An explanatory assessment using length-based indicators was performed using length-frequency distributions from the Spanish trawl fleet for the years 2016–2019 collected by the onboard observation programme (DCF programme). Landings of the trawl fleet represent the 85% of total landings for the Spanish fleet in this area. The assessment used the eight indicator ratios recommended by WKLIFE (ICES, 2015b) and combined catch data from bottom trawls and trammel nets raised to the corresponding fleets. The reference indicator ratio $L_{mean}/L_{F=M}$ (mean length of individuals larger than the length at first capture over the theoretical average length resulting from exploitation with a fishing mortality equal to natural mortality, which is a proxy for F_{MSY}) suggested that the stock was sustainable exploited (values of 1.00 and close to 0.97 and 0.99). More information in the stock annex.

19.9.5 Cuckoo ray (*Leucoraja naevus*) in Division 9.a (west of Galicia, Portugal, and Gulf of Cadiz) (rjn.27.9a)

The status of this stock is evaluated based on survey data from the Spanish ARSA surveys in Gulf of Cadiz (Q1 SP-GCGFS and Q4 SP-GCGFS).

Both ARSA surveys series indicate a long-term increasing trend, with the highest records of abundance and biomass in 2017 and 2018 (Figure 19.12a–b).

The ratio between the mean biomass index for the last two years (2018–2019) and the mean biomass index for the reference period (2013–2017) was 1.32. The existence of a consistent increasing trend was confirmed by applying the Mann-Kendall trend test to the last 10 years of time series (tau = 0.6, p-value = 0.02).

Although not used in the assessment, due to some missing values in recent years (2004, 2010, 2012, and 2019), the data series from the NepS (FU 28–29) also indicates an overall stable trend (figures 19.11b–c).

Discards from the Spanish fleet were available for this stock where discards from the Portuguese fleets are considered negligible. Thus, following ADG recommendations, discards were included in the assessments for this stock as well as rjn.27.8c stock. This resulted in a shift from landings to catch advice in this stock this year. Previous landings advice for 2019 and 2020 was 70 tonnes. In 2020, the recommended catch advice for 2021 and 2022 was 120 tonnes which correspond to landings advice of 84 tonnes.

19.9.5.1 Exploratory LPUE

As the PtGFS-WIBTS-Q4, the NepS (FU 28–29) survey was not conducted in recent years (2019–2020) and the continuity of the series is uncertain. And although not used to provide advice for rjn.27.9a, due to the irregularity in the series, it is used as auxiliary information. Considering this, and the fact that the ARSA surveys used currently as basis to provide advice only covers a small part of the stock area, an alternative assessment approach using a standardized commercial LPUE series was explored and presented in the WKSKATE meeting (Serra-Pereira *et al.*, 2020 WD; ICES, 2021b). The method is the same as that used for rjh.27.9a and is described in the stock annex for rjh.27.9a (see also Section 19.9.2.2, LPUE for rjc.27.9a). In brief, it considers the estimated landed weight of the species per trip (fishing effort unit) from the Portuguese polyvalent fleet using nets. Portuguese landings represented, on average, 92% of the total reported landings and the polyvalent fleet represented 67–81% in the last three years for the overall stock. The landed weight per trip is obtained by applying the stepwise statistical methodology described in Figueiredo *et al.* (2020c), in which the vessels are stratified by size and fishing seasonality. Vessels classified in the same *strata* are known to operate similarly in terms of fishing time, size of gear and fishing areas. As for rjc.27.9a, no changes in the fishing areas explored or in the distributional area for this stock were observed over the years. Therefore, it is considered unlikely that LPUE are not reflecting the biomass in the exploited areas. The rationale for adopting the fishing trip as effort unit is explained in Section 19.9.2 of this report (see ICES, 2021b for more details).

Several explanatory variables were investigated as potential candidates and the selection of the best model was done through residual graphical analysis and AIC comparison. Those included in the best GLM model (explained variance = 0.58) were: year, quarter, vessel size, fishing seasonality on skates and rays and fishing gear (trammel nets or gillnets) (Figure 19.4e). Annual standardized estimates of CPUE and the corresponding standard error were determined for a reference condition of the variables included in the model apart from the year level (Figure 19.4f).

So, in order to include the new LPUE series as basis to provide advice for rjn.27.9a in 2022, the method was presented (Serra-Pereira *et al.*, 2020 WD) and evaluated during WKSKATE and peer-reviewed by an external review group, as a recommendation from ICES ACOM (ICES, 2021b). In brief, WKSKATE acknowledged the adequacy of the Portuguese commercial LPUE series to assess the status of this stock and accepted its use for the next advice, due in 2022; the reviewers also recognized the choice made by the group to look at the use of LPUEs as an alternative to surveys and made suggestions for further improvement (see Section 19.9.2 and ICES (2021b) for more details). The main concern from the reviewers about the methodology proposed was the non-inclusion of the zeroes in the analysis. The rationale for choosing this approach is described in detail in ICES (2021b) and in Section 19.9.2 of this report. Additional analysis to justify the choice of not including the zeroes in the model will be presented in 2022.

In 2021, the model was updated (explained variance = 0.56, AIC = 23 589) (Figure 19.4f). The best model selected with the updated dataset included all the variables mentioned for the previous model. The mean annual biomass index (kg/trip) scaled by the overall mean for 2019–2020 was 11% smaller than the observed in the preceding five years. For comparison purposes with the current assessment methodology, the LPUE data series was normalized to the long-term mean and compared with the normalized biomass Index obtained from the NepS (FU 28–29) survey (Figure 19.4f). In general, followed similar trends, although the survey series has gaps in 2010, 2012, 2019 and 2020. Also, to note that the survey index is a screenshot in time during a specific time of the year (Q2) whilst the LPUE series is based on information collected throughout the year, so a lag between the two is to be expected. Also, as cuckoo ray is not very abundant in the surveys, the uncertainty of the estimates is larger than those for the thornback ray; considering that, most of the LPUE estimates are within the range of the CI.

19.9.6 Spotted ray (*Raja montagui*) in Subarea 8 (Bay of Biscay and Cantabrian Sea) (rjm.27.8)

In 2019, the biomass index for *R. montagui* in the Spanish IEO Q4-IBTS survey (1.63 kg/haul) is one the highest recorded in Division 8.c since 2002 (Figure 19.7a). Although in the survey *R. montagui* is very scarce in Division 9.a in the time series, in 8.c has been frequent, specifically in the central area of the Cantabrian Sea.

The ratio between the mean biomass index for the last two years (2018–2019) and the mean biomass index for the reference period (2013–2017) was 1.20.

Some estimates of discards are available only since 2015 but considered to be incomplete and the overall discard rate is considered unknown.

Supporting studies using data from French on-board observations indicate that *R. montagui* is observed in a small proportion of hauls. There have been more records in recent years (Figure 19.15). The reliability of this potential indicator may, however, be undermined by confusion between *R. brachyura* and *R. montagui*.

Raja montagui is caught sporadically in the EVHOE survey, mostly in the north and therefore this survey is not representative for this stock. The species in caught in larger quantities in the Celtic sea Figure 19.13). The occurrence of this species in on-board observations of commercial fishing does not suggest recent change in abundance (Figure 19.15).

19.9.7 Spotted ray (*Raja montagui*) in Division 9.a (west of Galicia, Portugal, and Gulf of Cadiz) (rjm.27.9a)

The status of this stock is currently evaluated using only data from the Portuguese Autumn Groundfish Survey (PtGFS-WIBTS-Q4), which covers most of the spatial distribution of the stock. The biomass and abundance indices have been stable along the time-series, with an increasing trend in 2014–2015 and stable in 2016–2017 (Figure 19.11b). The length distribution was relatively stable along the time-series, with the mean length above the average in 2016 and slightly below the average in 2017 (Figure 19.11c). The ratio between the average biomass index for the last two years (2016–2017) and the average biomass index for the reference period (2011–2015) is 1.32. The PtGFS-WIBTS-Q4 was not conducted in 2012 and 2019. In 2018, the survey had technical problems, and part of the stations were sampled using a commercial trawler and a different fishing net (using FGAV019 instead of NCT). Consequently, and since most of the main spatial distribution of the stock was not sampled with the standard procedure (southwest and south coast) the survey index was not possible to obtain. These two problems combined, resulted in a lack of data for the last 2 years (2018 and 2019) making it impossible to apply the ICES approach to data-limited (category 3) stocks, and the stock was evaluated as category 5. Also, there is still doubts if the PtGFS-WIBTS-Q4 time series will have continuity in the future.

The time-series for *R. montagui* in the ARSA surveys is irregular and with very low catches although a high peak in the biomass and abundance values was observed in 2015 and 2016. There are no records of this species in the Spanish IEO Q4-IBTS survey in Division 9.a over the whole time-series. For these reasons the Spanish surveys are not used in the assessment.

19.9.7.1 Exploratory LPUE

Because of the problems with the PtGFS-WIBTS-Q4 survey data availability in 2018–2020 and uncertain future, an alternative assessment approach using a standardized commercial LPUE series was explored and presented in the WGEF 2020 meeting. The methodology adopted is the one currently in use to provide advice for rjh.27.9a and described in the stock annex for this stock. In brief, it considers the estimated landed weight of the species per trip (fishing effort unit) from the Portuguese polyvalent fleet using nets, which represents more than 80% of the Portuguese landings that on its own accounts for more than 95% of the total landings for the stock. The landed weight per trip is obtained by applying the stepwise statistical methodology described in Figueiredo *et al.* (2020c), in which the vessels are stratified by size and fishing seasonality. Vessels classified in the same *strata* are known to operate similarly in terms of fishing time, size of gear and fishing areas (e.g., smaller vessels tend to operate closer to shore than bigger vessels). As for rjc.27.9a, no changes in the fishing areas explored or in the distributional area for this stock were observed over the years. Therefore, it is considered unlikely that LPUE are not reflecting the biomass in the exploited areas. The rationale for adopting the fishing trip as effort unit is explained in Section 19.9.2 of this report (see ICES, 2021b for more details).

Several explanatory variables were investigated as potential candidates and the selection of the best model was done through residual graphical analysis and AIC comparison. Those included in the best GLM model (explained variance = 0.78, AIC = 148 809) were: year, quarter, landing port, vessel size ("SIZEs"), fishing seasonality on skates and rays ("SAZ") and fishing gear (trammel nets or gillnets) (Figure 19.4g). Annual standardized estimates of CPUE and the corresponding standard error were determined for a reference condition of the variables included in the model apart from the year level. For comparison purposes with the current assessment methodology, the LPUE data series was normalized to the long-term mean and compared with the normalized biomass Index obtained from the PtGFS-WIBTS-Q4 survey (Figure 19.4h). In general, both time-series followed similar trends, although the survey series has gaps in 2012, 2018 and 2019. Also, to note that the survey index is a screenshot in time during a specific time of the year (Q4) whilst the LPUE series is based on information collected throughout the year, so a lag between the two is to be expected. Also, as spotted ray is not very abundant in the surveys, the uncertainty of the estimates is larger than those for the thornback ray; considering that, most of the LPUE estimates are within the range of the CI.

Considering the period used in the 2018 advice, the ratio between the average biomass index for the last two years (2016–2017) and the average biomass index for the reference period (2011–2015) is 1.20 compared to 1.32 obtained with the biomass survey index, which would result in the same advised landings for 2019 and 2020. Using the LPUE to advise for landings in 2021 and 2022, the ratio between the average biomass index for the last two years (2018–2019) and the average biomass index for the reference period (2013–2017) is 0.87.

It is highlighted that the LPUE series is currently the only data source available to assess the status of rjm.27.9a stock, being also considered a reliable source of information and representative for the stock. So, in order to use the new LPUE series as basis to provide advice for rjm.27.9a in 2022, the method was presented (Serra-Pereira *et al.*, 2020 WD) and evaluated during WKSKATE and peer-reviewed by an external review group, as a recommendation from ICES ACOM (ICES, 2021b). In brief, WKSKATE acknowledged the adequacy of the Portuguese commercial LPUE series to assess the status of this stock and accepted its use for the next advice, due in 2022; the reviewers also recognized the choice made by the group to look at the use of LPUEs as an alternative to surveys and made suggestions for further improvement (see Section 19.9.2

and ICES (2021b) for more details). The main concern from the reviewers about the methodology proposed was the non-inclusion of the zeroes in the analysis. The rationale for choosing this approach is described in detail in ICES (2021b) and in Section 19.9.2 of this report. Additional analysis to justify the choice of not including the zeroes in the model will be presented in 2022.

In 2021, the model was updated (explained variance = 0.75, AIC = 124 958) (Figure 19.4h). The best model selected with the updated dataset included all the variables mentioned for the previous model, except the variable fishing gear. Annual standardized estimates of CPUE and the corresponding standard error were determined for a reference condition of the variables included in the model apart from the year level. The mean annual biomass index (kg/trip) scaled by the overall mean for 2019–2020 was 9% smaller than the observed in the preceding five years.

19.9.7.2 Exploratory length-based indicators

The LBI indicators for rjm.27.9.a caught by the Portuguese polyvalent fleet, which represents around 80% of total landings in Portugal, are presented in Table 19.8b (considering 3 cm length classes). These results were expected as threshold levels are considered inappropriate for elasmobranchs. As discussed in WGEF 2020, the most reliable indicator is the MSY related indicator ($L_{mean}/L_{F=M}$) which suggest that the rjm.27.9.a stock is exploited at sustainable levels. Despite being below the threshold adopted (WKLIFE V), the values in 2018 and 2019 are very close to 1.

19.9.8 Undulate ray (*Raja undulata*) in divisions 8.a-b (Bay of Biscay) (rju.27.8ab)

The EVHOE survey is uninformative for this stock because the distribution of *R. undulata* is more coastal than the area surveyed. Exploratory assessments were presented by Biais *et al*. (2014 WD) and summarized in Section 19.8.2.

As the discard rate for this stock is very high (0.94) in the period 2015–2019 and the advised catches issued in 2018 were 202 tonnes, the latest assessment advised that no more than 13 tonnes should be landed in years 2020–2021. The advised catches and corresponding landings have remained constant since 2018.

Data collected from the French on-board observation programme carried out in application of the EU data collection programme indicated that *R. undulata* is caught in a high proportion of hauls in three métiers. The numbers of observations by métiers catching the species are unbalanced. The main métier catching *R. undulata* was GTR_DEF, and data suggested a steady increase in occurrence until 2014 followed by a stabilization. This is based upon more than 6000 observed hauls (Figure 19.13b). The other three selected métiers have either a high occurrence of the species with a moderate on-board observations sample size (OTB_CEP, OTB_DEF) or a low occurrence and a high total number of observations (GNS_DEF). The proportion of hauls catching the species has increased in OTB_CEP and OTB_DEF in recent years (Figure 19.16).

19.9.9 Undulate ray (*Raja undulata*) in Division 8.c (Cantabrian Sea) (rju.27.8c)

There are no longer-term survey data to assess temporal trends in this stock.

Scientific studies carried out in the eastern parts of Division 8.c have been conducted to characterize the specific composition of the landed skates, the species-specific CPUE and the geographical distribution of the catches (Diez *et al.*, 2014). During the period, 2011–2013, up to 118 trips/hauls of 21 vessels of the trammel net fleet from the nine main ports of the Basque

Country were sampled. *Raja undulata* was the fifth species in quantity caught and made up only 5% of the total skates catches.

Whilst the total estimated ICES landings from 2005–2014 were 0 t, this period covers several years for which species-specific data were not required and then a period for which *R. undulata* could not be landed legally. Following relaxation of the prohibited status in 2015, and allowance for small quantities of bycatch, landings between 5–9 tonnes were reported.

The historical landings data is uninformative and unrepresentative of population levels Partial discards are available in two years since 2015 therefore it is considered very incomplete. According to fishing interviews, this species is locally frequent and distributed in the coastal waters of Division 8.c, although not very abundant in catches. This situation may not have changed over the years.

R. undulata is very scarce in the Spanish IEO Q4-IBTS survey in Division 8.c and usually lower than 0.1 kg $haul^{-1}$ in any year of the series. In 2019, nine individuals of this species, ranging from 38 to 93 cm, were captured between 40 and 84 m deep in the Central and Eastern Cantabrian Sea. This due to the fact this species is distributed mainly out of the surveyed ground, in shallower areas not covered because they are not accessible to the vessel and the gear used.

19.9.10 Undulate ray (*Raja undulata*) in Division 9.a (west of Galicia, Portugal, and Gulf of Cadiz) (rju.27.9a)

Raja undulata is absent in the Spanish IEO Q4-IBTS survey in Division 9.a and rarely caught in the Portuguese demersal survey (PtGFS-WIBTS-Q4).

In 2015, IPMA developed a dedicated project to *R. undulata* – UNDULATA that involved onboard-observations, self-sampling and tagging studies (see ICES, 2020; Figueiredo *et al.*, 2015, WD and Maia *et al.*, 2015, WD for a full acount). The main results of the UNDULATA project was that the estimated median total landed weigth of *R. undulata* ranged from 157 and 271 tonnes during the period 2003–2008 (Table 19.9).

Additionally, under the same project, a mark-recapture study was carried out. A total of 353 specimens were tagged in the area of Sesimbra/Setúbal and 170 in the area of Peniche. Total length of tagged females ranged from 52 to 93 cm and from 57 to 89 cm for males. A total of 37 recaptures were recorded, which represented 10% of the tagged specimens. The maximum recorded travelled distance was 26 km and 75% of the recaptures were located at distances less than 10km from the tagging location. The longer period between tagging and recapture was 313 days and 50% of the tagged specimens were recaptured more than 54 days after the tagging event. The majority of the movements (from tagging locations to recapture locations) were recorded down to 50 m deep and seem to followed the shoreline between Sesimbra and Sines which reinforced the previous knowledge that the species prefers shallow sandy coastal areas.

Within the specimens tagged inside the Sado Estuary (n = 70), only three were recaptured during the Project period. From the recaptured specimens, one female with 85 cm TL tagged in February was recaptured outside the estuary area 142 days after and 10 km away from the tagging location in July. In Portuguese continental waters, the species has a reproductive peak between December and May (Serra-Pereira *et al*. 2015) and estuarine areas are given as possible spawning grounds for the species (Prista *et al*., 2003; Moura *et al*., 2007) which could explain this movement from the estuary to the outside area.

These preliminary results indicate that *R. undulata* do not display wide migration patterns, confirming the species high degree of site fidelity.

Following the opening of a TAC in 2016, data were collected from 2016 following and adapting the procedure developed during the UNDULATA project (Figueiredo *et al.* 2015, WD) in order to estimated landings and the potential stock biomass. Data were reliable from 2017, 2016 being an experimental phase used to stabilize the self-sampling with fishermen.

For 2017, by adapting the procedure developed during the UNDULATA project in 2015 (Figueiredo *et al.* 2015, WD), the potential abundance of *R. undulata* was estimated for different regions off the Portuguese continental waters (Figueiredo *et al.*, 2020b). For estimating *R. undulata* potential abundance the two predictors, depth and bottom sediment, considered to be closely related to the species distribution, were included in the model (Figure 19.19). The potential biomass was estimated by multiplying the abundance estimates by an estimate of the mean individual weight:

Region	Year	Potential total abundance (n)	Area (km_2)	Average potential number per km_2	Potential total estimated weight (t) (n*average weight)
North	2017	236034.2	1525.3	154.7	1426.5
Centre	2017	10772.8	3503.6	3.1	65.1
Southwest	2017	201456.7	2132.9	94.4	1217.5
South	2017	1641420	1330.4	1233.8	9919.9

In 2018, due to late assignment of licenses, the information available was considered insufficient for the adjustment of the statistical model proposed. In 2019, the DGRM introduced a landing control process under which vessels possessing a special fishing license continue to be obliged to provide additional information on their fishing activity related to *R. undulata* captures. Additionally, vessels not possessing the special fishing license were allowed to land a maximum of one specimen per trip and were also obliged to provide additional information on their fishing activity related to *R. undulata* captures. Under this new data collection scenario, information on null catches is no longer available and, therefore, not suitable for adjustment of the statistical model proposed to estimate *R. undulata* potential abundance. As a consequence, nor landings nor the potential abundance could be estimated for years 2018–2020.

A CPUE exploratory analysis was performed through the adjustment of a zero-truncated poisson regression model, which are used to model count data for which the value zero cannot occur and considering a pospoisson distribution. It is important to note that the numbers reported are bycatch highly constrained by very specific legislation on the species fishery and fishermen really tend to avoid areas where they known the species occurr and/or concentrates. Given this it is important to keep in mind that we are modeling the probability of encounter the species given certain variables. The input data used to perform the exploratory analysis was collected under the scope of the *R. undulata* monitoring program between 2016 and 2018. The response variable was the number of specimens caught per fishing haul and the explanatory variables considered were the year and quarter. The results of the zero-truncated Poisson regression analysis on the full model, containing both variables, year (2016–2018) and quarter (1–4) are presented in Table 19.10. The analysis of the explanatory variables coefficients, particularly year levels, show variability along the period but without any clear trend. This suggest that the low levels of exploitation, which are exclusively TAC driven, have had no significant impact on the stock. The plot of the residuals versus fitted values, shows that the mean is around zero across all the fitted levels, indicating there were no strong violations of the underlying assumptions (Figure 19.20). It is important to note that although it is a preliminary exploratory analysis and that the available time-series of fishery data on *R. undulata* is still short, it is considered a reliable source for the monitoring of species stock status in the future. A more detailed data and methodology analysis considering the incorporation of other explanatory variables such as mesh size, substrate type, depth and distance to coast, is taking place.

19.9.11 Blonde ray (*Raja brachyura*) in Division 9.a (west of Galicia, Portugal, and Gulf of Cadiz) (rjh.27.9a)

This is a coastal species with a patchy distribution that is caught infrequently by both Spanish and in Portuguese surveys in Division 9.a (usually lower than 0.1 kg $haul^{-1}$ in any year of the series). Consequently, abundance indices derived from these surveys are not considered indicative of stock status. In this case, the status of the stock is assessed based on fishery-dependent data (landings, effort and length structure).

In 2020, *R. brachyura* standardized CPUE (Figure 19.4i) was updated. The data used comprised the Portuguese polyvalent landing estimates by trip for the Peniche landing port. As detailed in the stock annex, the standardization procedure is done via the adjustment of a GLM model to the matrix data, where the response variable is the blonde ray landed weight by trip. Several explanatory variables were investigated as potential candidates and the selection of the best model was done through residual graphical analysis. Annual estimates of CPUE and the corresponding standard error are determined for a reference condition of the variables included in the model apart from the year level (Figueiredo *et al.* 2020 (WD). Mean annual biomass index (kg/trip) scaled by the overall mean for 2019–2020 (69.42) was more than 20% greater than observed in the preceding five years (43.89).

19.9.11.1 Exploratory Yield per recruit and potential spawning ratio

The yield per recruit (Y/R) and potential spawning ratio (%SPR) curves at long term for different levels of fishing mortality and age of first capture (TC) were estimated using the polyvalent fishing data as described in the Stock Annex.

The actual F ($F_{CURR} = 0.17$) is at a level corresponding to about 30% of the virgin exploitable spawning biomass ($F_{30\%SPR} = 0.15$) indicating that the stock has been exploited at a sustainable fishing rate (Figure 19.17).

19.9.11.2 Exploratory of length-based indicators

The LBI indicator for the polyvalent fleet, which represents the major fraction of total landings of the stock, suggests that rjh.27.9.a is exploited at sustainable levels (Table 19.8c). Despite being below the threshold adopted (WKLIFE V), the values in 2018 and 2019 are very close to 1. These results were expected as threshold levels are considered inappropriate for elasmobranchs. Nevertheless, the results for the MSY related indicator, suggest that rjh.27.9.a is exploited at sustainable levels as most of the values obtained were around 1.

19.9.12 Common skate *Dipturus batis*-complex (blue skate *Dipturus batis* and flapper skate *Dipturus intermedius*) in Subarea 8 and Division 9.a (Bay of Biscay and Atlantic Iberian waters) (rjb.27.89a)

Dipturus batis-complex has been confirmed to comprise two species, the nomenclature have been stabilized in Last *et al.* (2016) the smaller species (the form described as *D. cf. flossada* by Iglésias *et al.*, 2010) is named common blue skate, *Dipturus batis* and the larger species flapper skate, *D. intermedius.*

These species are only caught occasionally in Subarea 8 and might not occur to any degree in Division 9.a.

There are no stock size indicators for the two species. Reported landings are low due to restrictive management measures and do not provide information on stock dynamics. Despite the *Dipturus batis*-complex being prohibited in EU regulations, some individuals were landed occasionally in French and Spanish fish markets in Subarea 8. In France, sampled specimens in fish markets included an adult female *Dipturus intermedius* (200 cm L_T) - a southerly record of the species in recent years; and small individuals of *Dipturus batis* caught at the Glénan archipelago (southern Brittany). As these species are now extirpated from inner shelf areas of their former range, fishermen are not always able to identify them accurately. Available information does not change the perception of the stock status of these species that occur at low levels in this ecoregion.

Differing to other areas, *D. oxyrinchus* was included in 2016 and in 2018 advice for the raj.27.89a and not for rjb.27.89a. It is important to highlight that all landings of the genus *Dipturus* from Portugal in Division 9.a refer to *D. oxyrinchus*, for Spain and France official landings of *D. oxyrinchus* were considered to be correctly identified and all the remaining official landings of the genus *Dipturus* from this ecoregion were allocated to *Dipturus* spp., as species identification problems persist among species of the genus *Dipturus* (Figure 19.18).

In 2021, information about *Dipturus* species were compiled for this ecoregion and discussed under the Tor *"Evaluate available data at species-specific level within the common skate-complex (Dipturus spp.) stock units in order to further increase our understanding of each individual species and their current status"*. See section 26.1 of this report for further details.

19.9.13 Other skates in Subarea 8 and Division 9.a (Bay of Biscay and Atlantic Iberian waters) (raj.27.89a)

Sandy ray *Leucoraja circularis* occurs on the deeper shelf and along the slope of the Bay of Biscay and in minor abundance in Portuguese landings. Minor occurrences of the shagreen ray *Leucoraja fullonica* are also observed to the North of Division 8.a, but this species is largely absent from Division 9.a. Owing to the higher abundance of these two species in the Celtic Seas, the Bay of Biscay may comprise the southern limits of the Celtic Sea stocks.

In divisions 8.a-b, occasional catches of *Raja brachyura* and *Raja microocellata* are found at the coast by artisanal fisheries. These two species are scarce in the historical time-series of the Spanish IEO Q4-IBTS survey in divisions 8.c and 9.a.

All four of these species are caught in too small numbers in the EVHOE survey to calculate reliable population indices.

In Division 9.a, *Raja microocellata*, *Raja miraletus* and *D. oxyrinchus* appear occasionally in landings. The two former species are caught in low numbers in Portuguese surveys.

As mentioned in the previous section, landings allocated to *D. oxyrinchus* were included in this stock.

19.9.14 Summary of the status of skate stocks in the Bay of Biscay and Atlantic Iberian waters

The following table provides a summary of stock status for the main species evaluated in 2020 and using ICES DLS approach.

Species	ICES stock code	ICES DLS Category	Perceived status
Thornback ray *Raja clavata*	rjc.27.8	3	No clear trend in survey indices
	rjc.27.9a	3	The stock size indicator shows an increasing trend since 1999
Cuckoo ray *Leucoraja naevus*	rjn.27.9a	3	The stock size indicator shows an increasing trend since 1998
	rjn .27.8c	3	The stock size indicator has been fluctuating with increasing trend since 2011
Spotted ray *Raja montagui*	rjm.27.8	3	The stock size indicator shows an increasing trend in last two years compared with the five precedents.
	rjm.27.9a	3*	The stock size indicator shows a higher level in recent years than in 2005–2012, but has decreased in 2016-2017.
Undulate ray *Raja undulata*	rju.27.8ab	6	Survey data are not informative for this stock
	rju.27.8c	6	Survey data are not informative for this stock
	rju.27.9a	6	Survey data are not informative for this stock
Blonde ray *Raja brachyura*	rjh.27.9a	3	The stock size indicator shows an increasing trend since 2011.
Common skate *Dipturus batis* complex	rjb.27.89a	6	Available data do not inform on stock dynamics, species composition, catch, or landings. There are currently no robust stock size indicators.
Other skates	raj.27.89a	6	There are insufficient data available to assess these species. The decline in landings is due primarily to the improved species-specific reporting.

*Evaluated as Category 5 due to absence of survey data in 2018–2019.

19.10 Quality of assessments

No full analytic stock assessments have been conducted for skates in Subarea 8 and Division 9.a.

LPUE data for *L. naevus and R. clavata* are available for divisions 8.abd since 2001. Since 2008 LPUE were made available for *R. clavata*, *R. microocellata*, *R. montagui*, *R. undulata* and *R. brachyura* in Division 9.a. The inclusion of the standardized LPUE series in the assessment of *R. clavata, R. montagui* and *L. naevus* in Division 9.a were reviewed by WKSKATE and peer-reviewed by an external review group (ICES; 2021b).

In the most recent years, a lot of effort has been made by the countries involved in the demersal elasmobranch fisheries on this ecoregion to provide species-specific landings of skates. As a result of this improvement in the data, 19 different species have been identified (plus general categories “Rajidae”, “Torpedinidae” and “Myliobatidae”) from catches in subareas 8 and 9. A summary of the information available of the species-specific landings of skates by country is shown in tables 19.1f and 19.2.

The French DCF programme of on-board observations was used as supporting information to appraise temporal trends in stock abundances. Abundance was assessed by the proportion of fishing operations (trawl haul or net set) with catch (discards, landings or both) of the species in the stock area from 2007–2015. Fishing operations were aggregated by DCF level 5 métiers. The four-top ranking métiers (limited to those with more than 50 sampled hauls) were used to indicate stock status.

As for surveys in other ecoregions, surveys in Subarea 8 and Division 9.a were not specifically designed for elasmobranchs, producing a high frequency of zero-catch data. The fishing gear used and the survey design are not the most appropriate to sample elasmobranchs, especially for species with patchy distributions. Surveys do not cover coastal and estuarine areas, and therefore do not provide indicators for stocks distributed in shallow waters. Nevertheless, for some stocks, surveys provide reliable biomass indices.

Efforts have been made to overcome data limitations in order to standardize the fishery-independent abundance indexes, using as an example the estimates for *R. clavata* data from the autumn survey (PtGFS-WIBTS-Q4) in Division 9.a (Figueiredo and Serra-Pereira, 2013 WD). To deal with the large amount of zero-catches a generalized linear mixed model (GLMM) was fitted to the data, assuming a Tweedie distribution for the observations. One of the main purposes of applying a GLMM was to incorporate in the model variables that could account for differences between years, namely the difference between stations, depths, survey methodology, etc. Some decisions/assumptions had to be taken in order to proceed with the analysis of the data, including the determination of a subset of the available data, which better represent the geographical distribution of the species.

Tagging studies of *R. undulata* have shown that the distribution of this species is discontinuous, confirming the 2013 tagging results and the need to assess the state of the stocks of this species for areas that fit with the limited movements that this species may make. This behaviour may be a benefit for obtaining mark–recapture stock estimate as the one provided for the central part of the Bay of Biscay. Results allow an exploratory analysis including a lot of assumptions. Consequently, it must be regarded as only indicative of the biomass trend.

In Portuguese waters, the coastal distribution of *R. undulata* and its habitat preferences, shallow sandy bottoms (~ down to 50 m) hinders the collection of adequate data from IPMA surveys that allow to inform on stock status. In addition, the small by-catch quota assigned to Portugal is considered insufficient to obtain the complete spatial coverage of the species distribution area and by that estimate its potential abundance using the self-sampling data provided by licensed fishing vessels.

Regarding data needs for future monitoring of the stock, the sampling requirements referred in 2017 are maintained. Those requirements are related to the necessity of the full spatial sampling coverage of the species in Portuguese continental waters. Figure 19.21 presents the sampling spatial requirements for the full coverage.

19.11 Reference points

In 2020, new trials were performed using LBI in some of the Biscay and Iberia skate stocks: *Raja undulata* in divisions 8.a-b, *R. brachyura* in Division 9.a, *R. clavata* in Division 9.a and *R. montagui* in Division 9.a and *L. naevus* in 8.c. (see sections 19.8 and 19.9 for more details or respective stock annexes).

The constraints on the use of LBI to inform on elasmobranch stocks were discussed during the 2020 meeting. Following the WGEF 2020 discussions, the LBI indicator related to MSY was considered to provide valuable information about the stock status.

19.12 Conservation considerations

Initial Red List assessments of North-east Atlantic elasmobranchs were summarized by Gibson *et al.* (2008). In 2015, the European Red List of Marine Fishes was published (Nieto *et al.*, 2015), and relevant listings given below (noting that these are on a Europe-wide scale for each species, and are not stock-based):

Species	IUCN Red List Category
Dipturus batis	Critically Endangered
Rostroraja alba	Critically Endangered
Leucoraja circularis	Endangered
Leucoraja fullonica	Vulnerable
Dipturus oxyrinchus	Near Threatened
Raja brachyura	Near Threatened
Raja clavata	Near Threatened
Raja microocellata	Near Threatened
Raja undulata	Near Threatened
Leucoraja naevus	Least Concern
Raja miraletus	Least Concern
Raja montagui	Least Concern

19.13 Management considerations

A TAC for skates in this region was only introduced in 2009, along with requirements to provide species-specific data for the main commercial species (initially *L. naevus* and *R. clavata* and, since 2013, *R. brachyura*). Consequently, there is only a relatively short time-series of species-specific landings. In the case of Portugal, estimates of species-specific landings based on DCF sampling data are available since 2008.

Landings of *Raja undulata* were not allowed between 2009 and 2014 (inclusive), with a bycatch allowance only established for Subarea 8 since 2015, which was then extended to Division 9.a. in 2016. Consequently, landings data for *Raja undulata* are not indicative of stock status. However, landings and discards data could be indicative of stock status for this species along with several monitoring years according to self-sampling programs (French and Portuguese) in these areas.

Currently, fishery-independent trawl survey data provide the longest time-series of species-specific information. These surveys do not sample all skate species effectively, with more coastal species (e.g. *R. brachyura*, *R. microocellata* and *R. undulata*) not sampled representatively.

The status of more offshore species, such as *L. circularis* and *L. fullonica*, are poorly understood, but these two species may be more common in the adjacent Celtic Seas ecoregion (see Section 18).

Some of the larger-bodied species in this ecoregion are from the genus *Dipturus*, but data are limited for all these species, with some potentially more common further north.

19.13.1 Fishery-science projects to estimate abundance of *Raja undulata* stocks

In 2015, a monitoring plan for *R. undulata* was required by WGEF. This involved the design of a fishery scientific survey (e.g. sentinel fishery) which would function in cooperation with commercial fishermen, in particular small-sized vessels and inshore where the species tend to concentrate. A detailed description of the sentinel fishery regarding main aspects in the sampling plan design and data requirements was presented in ICES WGEF reports 2015 and 2016.

Data requirements are summarized below:

Vessel	Vessel name and registration number Vessel technical characteristics (e.g. LOA, tonnage, power, etc.) Registration port Skipper identity and experience
Trip	Date and time of departure/arrival Fishing port of departure/arrival Observer's Identification
Environment condition	Tidal state, sea conditions (e.g. wave height, wind strength) Water temperature
Gear characteristics	Gear type, state (new, good state) For gillnet and trammel net: length and height in meters, mesh in millimetres, number of net units, length of a net unit sheet For longline: length in meters, number, size and type of hooks, type of bait For trawl, dredge: gear dimensions, mesh size, trawling speed, presence of tickler chains, description of gear
Fishing haul	Operation ID Date/time of gear deployment and retrieval Geographic location of the fishing haul (including set and hauling) Fishing depth Soaking/trawling time
Biological data	From all the target species, data collected should include: Coordinates of the capture location Biometric measurements such as total length (from nose to tip of tail), width (from one wing to the other) and body weight Health status (lively, sluggish or dead) Sex Maturity stage (whenever possible) Collected tissue samples of specimen (if from live fish, in accordance with appropriate animal welfare protocols) Survivorship of discarded individuals If marked, the number of the mark should be recorded

19.13.2 Monitoring of *Raja undulata* captures

In 2016, Council Regulation (EU) 2016/458 of 30 March 2016 amended Regulations (EU) 2015/523 as regards individual TACs for *R. undulata* in ICES Divisions.

The use of these *R. undulata* individual quotas was guided by scientific protocols *"to ensure the continuity of scientific studies and to assess the state of the resource and ensure, in the future, its sustainable exploitation"* (COUNCIL REGULATION (EU) 2016/72 of 22 January 2016). Under this regulation, only vessels possessing a compulsory fishery license were allowed to catch *Raja undulata*. Simultaneously, licensed vessels were obliged to record information on species captured by fishing haul and report it to national agencies (Direction des Pêches Maritimes et de l'Aquaculture, DPMA) of the French Ministry for Agriculture and Fisheries and to the General Directorate for Natural Resources, Safety and Maritime Services (DGRM) in France and Portugal respectively).

Portugal:

Historically, in the Portuguese official landings, *R. undulata* was landed under a generic category that encompasses several skate species. This situation limited the use of Portuguese official landings to evaluate historical landings of the species. Under the UNDULATA Project, historical landings of *R. undulata* for the period of 2003–2008 were estimated. The annual median estimates of *R. undulata* landed in Portugal mainland as well as the interquartile estimates are presented in Table 19.9.

Using fishery information from the small experimental quota set for *Raja undulata* since 2016 in ICES Division 9.a, estimates of the species catches along the continental coast were calculated for 2017. The data consisted of official national polyvalent daily landings for 2017, provided by the DGRM. Trips from vessels that landed *R. undulata* at least once during 2017 were used to create a classification rule. The classification rule was determined to predict the plausibility of *R. undulata* been caught in a fishing trip of a vessel of the polyvalent fleet operating in the Portuguese coast. For this, landings data at trip level and species composition of landings were used as predictors. Species considered were those occurring in more than 25% of the trips.

The analysis was performed for each region (North, Centre, Southwest and South) where the species is likely to concentrate. Also, given the well-known heterogeneity in the polyvalent fleet and the assumption that the catch weight is proportional to the vessel's capacity, vessel size category was considered in the analysis.

Fishery self-sampling data from the Portuguese monitoring plan for *R. undulata* were used to estimate mean caught number and weight for each group of region and vessel size category. Using these estimates, the number of trips with potentially positive catches of *R. undulata* and the total catch in weight per trip were calculated and then summed by region and vessel category (Table 19.11)

In 2021, further work is in progress to estimate the discards of this species which, in line with other fisheries in Europe, are considered to be quite high.

It is important to note that although the available fishery information on *R. undulata* is still short, it is considered a reliable source for the monitoring of species stock status. The role of fishermen in the monitoring process is a key element and they need to be aware of their importance on the process, in particular in providing reliable information. Although some of the weaknesses identified on fishermen's reports still persist, efforts are being made in close collaboration with the sector in order to overcome data deficiencies and improve the general quality of the information reported.

France:

Results are described in more detail in Gadenne (2017 WD).

The data collected during the self-sampling 2016 monitoring program indicate that 64 vessels participated in the protocol out of 125 authorizations issued. A total of 7079 hauls were reported, but only 64% were considered valid for analysis.

In 2016, a total of 41.5 tonnes were landed and discards of 117.7 tonnes were reported. Theese landings and discards were caught by 7 types of fishing gear (GND, GNS, GTR, LL, LLS, OTB, and OTT).

In the list of 26 authorized gears, seven gears were used by vessels participating in the self-sampling, with bottom trawls (OTB) and trammel nets (GTR) being predominant. Considering the average weight caught by fishing haul, nets (trammel and gillnets) and longlines appear to be the most suitable gears for catching undulate ray. However, longlines showed a higher rate of discards (85%), followed by trawls (~76%).

Data indicate that the species by-catch mainly occur in coastal areas of the Bay of Biscay. The monthly evolution of catches raises questions about high catch rates in the first months of the year compared to the rest of the self-sampling period. Following the protocol carefully and consistently over time is an essential condition to validate the trends observed.

In conclusion, the main benefit of this self-sampling program is the possibility of quantifying landings, discards and fishing effort for the species, which are crucial for proper stock evaluation and management.

This French self-sampling programme ended in 2019, thereafter it has no longer been required to possess a special licence to land undulate ray.

Spain:

The results from the DCF pilot study held from 2011–2013 and conducted in the Basque Country waters (Division 8.c) with the objective of describing and characterizing coastal artisanal fisheries (trammel nets targeting mainly hake, anglerfish and mackerel), showed that several skate species are caught as bycatch and *Raja undulata* was the fifth most important species caught reaching only the 5% of the total catches (Diez *et al.*, 2014 WD),

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Table 19.1a. Skates in the Bay of Biscay and Iberian Waters. Nominal landings (t) of skates by division and country (Source: ICES). Total landings (t) of Rajidae in divisions 8.a-b.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Belgium	12	15	9	9	12	4	9	4	6	8	5	4	3	1	2	2
France	2405	1960	1884	1799	1693	1461	1294	1202	1179	1349	1541	1220	1322	1463	1200	1043
Netherlands					0											
Spain*	422	332	373	352	275	163	228	113	242	243	212	262	210	256	213	170
UK	10	40	7	4	0	0	1	2	0		0	0	0	0		
Ireland											35	28				
Norway**		15	4													
Total	2850	2364	2312	2239	2000	1656	1551	1443	1427	1601	1811	1514	1534	1720	1415	1216

*** Includes 8.d (2005–2012, 2015–2016); ** Includes 8.c.**

Table 19.1b. Skates in the Bay of Biscay and Iberian Waters. Total landings (t) of Rajidae in Division 8.d.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
France	110	63	71	94	72	68	71	76	57	66	61	44	32	46	41	49
Spain	16	12	17	9	0	1	4	2	8	6	6		0	1	0	2
UK	0	3	1	0	0	0	1	0	0	0						
Ireland				0				0			0					
Total	127	77	89	103	72	69	75	78	66	72	66	44	32	47	41	51

Table 19.1c. Skates in the Bay of Biscay and Iberian Waters. Total landings (t) of Rajidae in Division 8.c.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
France	1	0	1	0	0	0	1	1	0	2	0	0	0	0	0	0
Spain**	177	194	420	433	533	551	663	654	608	528	344	388	377	541	525	450
Total	178	194	421	433	533	552	663	655	608	530	344	388	377	542	525	450

**** Includes 8.e (2015–2016)**

Table 19.1d. Skates in the Bay of Biscay and Iberian Waters. Total landings (t) of Rajidae in Division 9.a.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
France					1						0		0	0		
Portugal	1303	1544	1444	1439	1444	1454	1425	1122	1104	1026	1012	1026	1138	1105	1133	1227
Spain	301	283	139	134	276	409	429	468	481	455	253	304	348	381	436	430
Ireland					0											
Total	1604	1827	1583	1573	1722	1863	1853	1590	1585	1481	1265	1330	1487	1485	1569	1656

Table 19.1e. Skates in the Bay of Biscay and Iberian Waters. Combined Landings (t) of Rajidae in Biscay and Iberian Waters.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Belgium	12	15	9	9	12	4	9	4	6	8	5	4	3	1	2	2
France	2517	2023	1955	1893	1766	1529	1367	1279	1236	1418	1602	1264	1354	1510	1242	1092
Netherlands					0											
Portugal	1303	1544	1444	1439	1444	1454	1425	1122	1104	1026	1012	1026	1138	1105	1133	1227
Spain	918	823	985	1004	1104	1152	1342	1359	1339	1233	835	973	935	1179	1173	1052
UK	10	43	8	4	1	0	1	2	0	0	19	0	0	0		
Ireland				0	0			0			35	28				
Norway		15	4													
Total	4760	4462	4405	4349	4327	4140	4144	3766	3686	3685	3507	3296	3430	3795	3550	3373

Table 19.1f. Skates in the Bay of Biscay and Iberian Waters. Combined Landings (t) of Rajidae in Biscay and Iberian Waters (included Division 8e). Landings by ICES stock and country since 2005. Totals by country are presented in bold.

Country	ICES Stock code	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Belgium		**12**	**15**	**9**	**9**	**12**	**4**	**9**	**4**	**6**	**8**	**5**	**4**	**3**	**1**	**2**	**2**
	raj.27.89a	12	15	9	1	2	1	2	0	1	0	1	0	0	0	0	0
	rjc.27.8				2	2	1	2	2	3	3	1	2	1	1	1	1
	rjh.27.9a													0			
	rjm.27.8				0	0	0	0	0					0	0		
	rjn.27.678abd				6	8	3	4	2	3	5	3	2	1	1	1	1
France		**2517**	**2023**	**1955**	**1893**	**1766**	**1529**	**1367**	**1279**	**1236**	**1418**	**1602**	**1264**	**1354**	**1510**	**1242**	**1092**
	raj.27.89a	783	662	610	613	391	244	175	151	179	238	202	181	243	255	16	20
	rja.27.nea	1		0	0	3	0	1	1	0	1	3	1	0			
	rjb.27.89a	11	5	3	5	0	0	0	0	0	0	0	0	0	0		
	rjc.27.8	276	300	215	187	195	217	178	179	194	202	212	166	191	229	223	226
	rjc.27.9a													0	0		
	rjh.27.9a													0	0		
	rjm.27.8	155	130	124	106	64	86	91	86	109	121	149	132	153	172	222	188
	rjm.27.9a													0	0		
	rjn.27.678abd	1290	927	1002	981	1109	980	920	859	754	848	1025	769	745	837	758	636
	rjn.27.8c	0	0		0	0	0	0	0	0	2	0	0	0	0		0
	rjn.27.9a											0		0	0		
	rju.27.8ab	1	0		0	3	2	2	3	0	7	11	14	22	17	23	22
	rju.27.8c													0	0		
	rju.27.9a													0	0		
UK		**10**	**43**	**8**	**4**	**1**	**0**	**1**	**2**	**0**	**0**	**19**	**0**	**0**	**0**		
	raj.27.89a	10	43	8	2	0	0		0	0		1					

Country	ICES Stock code	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
	rjb.27.89a										**0**						
	rjc.27.8							1	2			17	0	0	0		
	rjm.27.8				1	1	0	0				1	0				
	rjn.27.678abd							0				0					
Ireland					**0**	**0**			**0**			**35**	**28**				
	raj.27.89a											4	5				
	rjb.27.89a				0	0						413	15				
	rjc.27.8								0			4	7				
	rjm.27.8											12	1				
	rjn.27.678abd											2	1				
Portugal		**1303**	**1544**	**1444**	**1439**	**1444**	**1454**	**1425**	**1122**	**1104**	**1026**	**1012**	**1026**	**1138**	**1105**	**1133**	**1227**
	raj.27.89a	104	123	38	307	308	293	276	240	144	132	113	99	116	142	120	121
	rja.27.nea	5	6														
	rjc.27.9a	480	569	472	745	739	611	811	570	643	585	578	559	620	654	621	670
	rjh.27.9a	495	586	459	193	163	221	161	165	179	174	236	221	235	191	255	335
	rjm.27.9a	76	90	119	144	184	275	121	108	111	101	67	68	94	57	82	58
	rjn.27.9a	43	51	79	50	50	55	56	39	27	34	20	57	39	23	31	19
	rju.27.9a	100	119	277									23	35	38	25	24
Spain		**918**	**823**	**985**	**1005**	**1104**	**1152**	**1342**	**1359**	**1340**	**1233**	**835**	**973**	**935**	**1179**	**1173**	**1052**
	raj.27.89a	918	823	985	1000	707	627	840	762	616	461	299	367	396	422	433	346
	rjb.27.89a	0		0	1												
	rjc.27.8		0	0	4	136	214	243	268	286	284	183	198	176	300	290	296
	rjc.27.9a					29	115	139	194	166	215	120	123	124	152	181	178
	rjh.27.9a					1	2	1	0	3	0	0	1	0	4	8	12
	rjm.27.8					11	26	22	19	28	40	28	26	27	44	45	42

Country	ICES Stock code	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
	rjm.27.9a			0		7	10	3	2	4	2	1	5	5	5	9	12
	rjn.27.678abd					193	119	59	74	203	204	184	225	169	205	165	125
	rjn.27.8c					18	34	24	26	33	27	15	13	15	23	13	9
	rjn.27.9a					3	4	12	13	2	0	0	1	2	2	8	4
	rju.27.8ab															0	0
	rju.27.8c											5	7	8	9	8	7
	rju.27.9a												8	12	15	13	21
Total general		**4760**	**4462**	**4405**	**4350**	**4327**	**4140**	**4144**	**3766**	**3686**	**3685**	**3508**	**3296**	**3430**	**3795**	**3550**	**3373**

Table 19.2a. Skates in the Bay of Biscay and Iberian Waters. Species-specific landings (in t) in divisions 8.abde since 2005. Last table includes landings of Skates (*Myliobatis* spp, Dasyatidae, *Rhinobatos* spp, Torpedinidae, Gymnuridae) in the same period.

8.abde	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Dipturus oxyrinchus	12	10	2	3	1	6	6	0	0	0	0	0	0			
Dipturus spp	11	5	3	5	0	0	0	0	0	0	13	15	0			
Leucoraja circularis	84	53	58	69	20	28	16	20	20	25	24	22	0		1	1
Leucoraja fullonica	14	8	7	7	45	37	36	30	30	38	47	40	27			
Leucoraja naevus	1290	927	1002	987	1310	1102	983	935	959	1057	1214	996	915	1043	923	761
Raja brachyura				0	11	11	18	7	27	67	65	76	144		5	7
Raja clavata	276	300	215	190	239	246	217	227	244	241	266	211	232	273	266	266
Raja microocellata	0	0	0	1	3	2	4	13	20	38	21	30	54			
Raja montagui	155	130	124	107	65	86	92	86	109	121	162	133	153	172	222	188
Raja undulata	1	0		0	3	2	2	3	0	7	11	14	22	17	23	22
Rajiformes	1135	993	986	974	373	206	252	199	83	79	52	19	18	263	17	20
Rostroraja alba	1		0	0	3	0	1	1	0	1	3	1	0	0		
Rajella fyllae									0							
Total	2979	2426	2398	2343	2072	1725	1627	1520	1493	1673	1878	1558	1566	1768	1456	1267

Table 19.2a cont. Skates in the Bay of Biscay and Iberian Waters. Species-specific landings (in t) in division 8.c since 2005. Last table includes landings of Skates (*Myliobatis* spp, Dasyatidae, *Rhinobatos* spp, Torpedinidae, Gimnuridade) in the same period.

8.c	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Dipturus oxyrinchus											3	0				
Dipturus spp.																0
Leucoraja circularis		0		4	1	2	1	1	1	0	0	0				0
Leucoraja fullonica		0		0	0					0			0			0
Leucoraja naevus	0	0		0	18	34	24	27	33	29	16	13	15	23	13	9
Raja brachyura					0	5	1	0	0	0	1	1	0		2	2
Raja clavata	0	0	0	4	94	186	206	224	238	248	150	161	136	256	247	257
Raja microocellata													0		1	0
Raja montagui					11	25	22	19	28	40	28	26	27	44	45	42
Raja undulata											5	7	8	9	8	7
Rajiformes	178	209	424	426	409	299	409	385	308	213	162	199	190	210	209	132
Total	178	209	424	434	533	552	663	655	609	530	364	408	377	542	525	450

Table 19.2a cont. Skates in the Bay of Biscay and Iberian Waters. Species-specific landings (in t) in division 9.a since 2005. Last table includes landings of Skates (*Myliobatis* spp, Dasyatidae, *Rhinobatos* spp, Torpedinidae, Gimnuridade) in the same period.

9.a	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Dipturus oxyrinchus				72	75	20	68	24	63	33	74	26	41	56	36	16
Dipturus spp.													0			
Leucoraja circularis	0	0	0	1	2	11	1	0	0	0	0	2	1	0	5	5
Leucoraja fullonica								0			0				0	0
Leucoraja naevus	43	51	79	50	53	59	68	53	29	34	20	59	41	25	38	23
Raja brachyura	495	586	459	193	164	223	162	165	182	174	236	222	236	195	263	347
Raja clavata	480	569	472	745	768	725	950	764	809	800	697	682	744	806	802	848
Raja microocellata	88	105	35	19	45	43	29	36	41	45	32	63	68	82	77	91
Raja miraletus	16	19		4	2	6	5	5	1	2	0	2	0	0	0	0
Raja montagui	76	90	119	144	191	284	124	110	115	103	68	73	99	62	90	69
Raja undulata	100	119	277									31	46	52	38	45
Rajiformes	301	283	142	345	421	491	447	432	345	289	139	171	210	207	218	212
Rostroraja alba	5	6														
Total	1604	1827	1583	1573	1722	1863	1853	1590	1585	1481	1265	1330	1487	1485	1569	1656

Table 19.2a cont. Skates in the Bay of Biscay and Iberian Waters. Species-specific landings (in t) in divisions 8.abde, 8.c and 9.a since 2005. Last table includes landings of Skates (*Myliobatis* spp, Dasyatidae, *Rhinobatos* spp, Torpedinidae, Gimnuridade) in the same period.

89.a	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Dasyatidae	1	2	0	0	0	0	0	0	0	0		0	0	0		2
Dasyatis centroura	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0
Dasyatis pastinaca	4	3	6	5	3	3	2	2	3	5	6	4				
Dasyatis spp.															0	0
Gymnura altavela	5	9	12	7	7	7	10	8	12	7	9	10	12	6	4	3
Myliobatidae														43	6	7
Myliobatis aquila	2	2	1	2	1	1	2	1	1	2	2	2	23	15	11	7
Pteroplatytrygon violacea					0			1								
Rhinobatos spp	0	0	0	0	0		0	0	0	0	0	0		0	0	0
Torpedinidae												16	18	18	16	2
Torpedo marmorata	27	24	25	28	25	22	20	20	23	14	18	16				22
Torpedinidae	39	49	45	46	39	50	54	39	43	46	43	33	45	32	30	32
Total	79	89	89	87	76	84	90	72	83	75	78	81	98	114	67	75

Table 19.2b. Skates in the Bay of Biscay and Iberian Waters Other skates and rays in Subareas 8 and Division 9.a. ICES estimates of landings by species and year (in tonnes).

Species	Fishing Area	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Dipturus oxyrinchus	27.8.a	11	2	1	3	0	5	6	0	0	0	0	0	0			
	27.8.b	0	6	0	0				0					0			
	27.8.c								0	0	0	3	0				
	27.8.d	1	1	1	0		0	0	0	0	0	0	0	0			
	27.9.a				72	75	20	68	24	64	33	74	26	41	56	36	16
Leucoraja circularis	27.8.a	72	48	52	59	18	22	14	17	15	20	21	16	0		1	1
	27.8.abd												2				
	27.8.b	2	1	1	0	0	3	1	1	2	1	1	2				0
	27.8.c		0		4	1	2	1	1	1	0	0	0				0
	27.8.d	10	4	6	10	2	3	2	2	3	4	2	2				
	27.8.e	0															
	27.9.a	0	0	0	1	2	11	1	0	0	0	0	2	1	0	5	5
Leucoraja fullonica	27.8.a	12	7	6	6	41	33	32	28	23	30	35	32	25			
	27.8.abd											5	4				
	27.8.b	1	1	0	0	0	1	1	0	5	5	5	3	1			
	27.8.c		0		0	0					0			0			0
	27.8.d	1	1	1	1	4	3	3	2	2	3	2	2	2			
	27.8.e				0												
	27.9.a								0			0				0	0

Species	Fishing Area	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Leucoraja naevus	27.8.a	1191	865	940	903	983	912	880	806	705	783	977	791	755	879	752	598
	27.8.abd					2	13		12			2	1				
	27.8.b	13	14	9	11	267	119	43	51	199	211	174	165	133	124	132	120
	27.8.c	0	0		0	18	34	24	27	33	29	15	13	15	23	13	9
	27.8.ce											0	0				
	27.8.d	87	48	54	73	59	58	59	66	56	63	55	39	27	40	39	41
	27.8.d.2											5			1		1
	27.8.e		0		0	0	0	0									
	27.9.a	43	51	79	50	53	59	68	53	29	34	20	59	41	25	38	23
Raja brachyura	27.8.a				0	8	7	4	6	25	63	63	75	142		5	7
	27.8.abd											0					
	27.8.b				0	3	4	14	1	2	4	2	1	2			
	27.8.c					0	5	1	0	0	0	1	1	0		2	2
	27.8.d					0	0	1	0	0	0	0	0				
	27.8.e								0			0					
	27.9.a	495	586	459	193	164	223	162	165	182	174	236	222	236	195	263	347
Raja clavata	27.8.a	245	246	172	152	141	159	112	100	95	100	127	99	124	170	169	164
	27.8.abd					1	1	0	25			20	7				
	27.8.b	29	52	42	36	93	84	99	96	147	138	117	106	107	102	95	96
	27.8.c	0	0	0	4	94	186	206	224	238	248	146	154	136	256	247	257
	27.8.ce											3	7				
	27.8.d	3	1	1	2	3	2	5	6	3	2	1	1	1	1	2	6
	27.8.d.2											0		0	0		0
	27.8.e	0	0		0	0	0	1			0	0					
	27.9.a	480	569	472	745	768	725	950	764	809	800	697	682	744	806	802	848

Species	Fishing Area	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Raja microocellata	27.8.a	0	0	0	0	2	1	1	2	6	12	12	15	37			
	27.8.b	0	0		0	0	0	3	11	14	25	9	15	17			
	27.8.c													0		1	0
	27.8.d			0	0	1	0		0	0	0	0	0	0			
	27.9.a	88	105	35	19	45	43	29	36	41	45	32	63	68	82	77	91
Raja miraletus	27.9.a	16	19		4	2	6	5	5	1	2	0	2	0	0	0	0
Raja montagui	27.8.a	104	78	78	65	59	74	86	85	105	119	147	131	151	170	220	185
	27.8.abd											13	1				
	27.8.b	49	51	46	41	6	12	4	1	3	2	2	2	2	1	1	1
	27.8.c					11	25	22	19	28	40	27	25	27	44	45	42
	27.8.ce											0	0				
	27.8.d	2	0	0	1	0	1	1	0	0	0	0	0	0	0	0	2
	27.8.e				0	0	0	0	0				0				
	27.9.a	76	90	119	144	191	284	124	110	115	103	68	73	99	62	90	69
Raja undulata	27.8.a					0	1	0	0	0	2	8	8	16	13	16	16
	27.8.b	1	0		0	3	1	2	2	0	5	3	6	6	4	6	6
	27.8.c											5	7	8	9	8	7
	27.9.a	100	119	277									31	46	52	38	45
Rajella fyllae	27.8.b									0							

Species	Fishing Area	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rajiformes	27.8.a	562	537	535	474	160	144	122	68	63	54	38	9	4	233	4	6
	27.8.abd	1	2	36	76	16	14	19	85								
	27.8.b	548	434	388	408	194	46	107	44	18	25	14	10	12	24	12	14
	27.8.bc		15	4													
	27.8.c	178	194	420	426	409	299	409	385	308	213	149	187	190	210	209	132
	27.8.ce											13	12				
	27.8.d	22	21	27	16	3	3	5	1	1	1	0	0	2	6	0	0
	27.8.d.2											0					0
	27.8.e	2		0	0	0					0	0		0	0		
	27.9.a	301	283	142	345	421	491	447	432	345	289	139	171	210	207	218	212
	27.9.b											0					
TOTAL		**4749**	**4458**	**4402**	**4344**	**4327**	**4140**	**4144**	**3766**	**3686**	**3685**	**3495**	**3281**	**3430**	**3795**	**3550**	**3373**

Table 19.3a. Skates in the Bay of Biscay and Iberian. Historical discard estimates (t) by country of the different stocks reported to the WGEF.

	raj.27.89a	rjb.27.89a	rjc.27.8	rjc.27.9a	rjh.27.9a	rjm.27.8	rjm.27.9a	rjn.27.678abd	rjn.27.8c	rjn.27.9a	rju.27.8ab	rju.27.8c	rju.27.9a
Belgium			**4**					**1466**					
2013			1					67					
2014			0					42					
2015			0					48					
2016			1					169					
2017			1					859					
2018								34					
2019								131					
2020			2					116					
Spain	**1**	**3**	**352**	**114**	**6**	**55**	**59**	**1244**	**37**	**91**		**1**	**22**
2015		3	78	31	0	1	1	315	11	4		1	0
2016			109	43	2	34	41	315	11	41			7
2017			27	7	0	2	12	128	3	22		0	14
2018			33	13	0	5	2	139	5	16		0	0
2019	1	0	36	21	3	12	3	241	8	7		0	1
2020			70					105					
France	**1595**	**19**	**110**			**219**		**3799**			**1040**		
2016	713		27			71		820			416		
2017	882		24			85		1030			230		
2018		19	22			0		667			271		
2019			10			63		855			122		
2020			27			0		428					
UK								**1593**					
2009								59					
2010								177					

	raj.27.89a	rjb.27.89a	rjc.27.8	rjc.27.9a	rjh.27.9a	rjm.27.8	rjm.27.9a	rjn.27.678abd	rjn.27.8c	rjn.27.9a	rju.27.8ab	rju.27.8c	rju.27.9a
2011								52					
2012								52					
2013								102					
2014								198					
2015								50					
2016								196					
2017								101					
2018								207					
2019								41					
2020								359					
Ireland								**8106**					
2009								857					
2010								1886					
2011								746					
2012								866					
2013								469					
2014								719					
2015								673					
2016								562					
2017								597					
2018								732					
2019								975					
2020								322					
Total	**1595**	**22**	**467**	**114**	**6**	**274**	**59**	**17506**	**37**	**91**	**1040**	**1**	**22**

Table 19.3b. Skates in the Bay of Biscay and Iberian Waters. Estimate of the relationship discards/catches (in percentage) of the *L. naevus* and *R. clavata* by the Basque OTB (Bottom otter trawl) in Divisions 8.abd.

Year	*L. naevus*	*R. clavata*
2009	4%	0%
2010	11%	3%
2011	14%	11%
2012	9%	1%
2013	18%	10%
2014	12%	3%
2015	30%	13%
2016	51%	52%
2017	50%	15%
2018	53%	12%
2019	42%	19%

Table 19.4a. Skates in the Bay of Biscay and Iberian Waters. Percentage of individuals by vitality status after capture (1 = Good; 2 = Moderate; 3 = Poor) in relation to mesh size and soak time in the Portuguese polyvalent fleet operating with trammel nets for *Raja clavata*, *Raja montagui*, *Raja brachyura*, *Leucoraja naevus* and *Raja undulata.* The total length range is also given.

			Vitality status				
Species	**Mesh size (mm)**	**Soak time (h)**	**1**	**2**	**3**	**n**	**TL range (cm)**
Raja clavata	< 180	< 24	100%	0%	0%	17	23-72
		> 24	72%	12%	16%	25	39-80
	> 180	< 24	92%	4%	4%	26	48-88
		> 24	52%	23%	24%	103	40-96
Raja brachyura	< 180	< 24	67%	22%	11%	9	39-66
		> 24	92%	4%	4%	24	27-75
	> 180	< 24	57%	19%	24%	21	49-95
		> 24	70%	20%	10%	143	18-106
Raja montagui	< 180	< 24	100%	0%	0%	18	21-64
		> 24	67%	21%	12%	42	10-60
	> 180	< 24	40%	30%	30%	20	46-62
		> 24	37%	33%	30%	43	37-68
Leucoraja naevus	< 180	< 24	1	-	-	1	53
	> 180	< 24	1	-	-	1	61
		> 24	58%	21%	21%	24	46-62
Raja undulata	< 180	< 24	82%	16%	2%	44	40-89
		> 24	90%	5%	5%	58	43-92
	> 180	< 24	79%	7%	14%	71	32-92
		> 24	96%	1%	3%	174	44-92

Table 19.4b. Skates in the Bay of Biscay and Iberian Waters. Percentage of individuals by vitality status (1 = Excellent; 2 = Good; 3 = Poor; 4 = Dead) of each species assessed onboard IPMA's otter trawl surveys, for different deck times. For n ≤ 5, observed numbers by vitality are shown instead of percentages.

Species	Survey	Deck time	Length class	1	2	3	4	n	TL range (cm)
Raja clavata	PT-CTS	< 108 min	< 52 cm	47%	13%	33%	7%	30	
		< 108 min	> 52 cm	4	-	1	-	5	
		> 108 min	< 52 cm	0%	0%	0%	100%	25	
		> 108 min	> 52 cm	-	1	-	3	4	
	PTGFS-WIBTS-Q4	< 108 min	< 52 cm			1	1	2	
		< 108 min	> 52 cm	26%	46%	23%	6%	35	

Table 19.5. Skates in the Bay of Biscay and Iberian Waters. Relative estimated landed weight (%) for skate species for the Portuguese polyvalent and trawl fleets (2008–2020).

	Polyvalent												
	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Raja miraletus	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Raja clavata	48%	48%	40%	54%	44%	56%	53%	53%	51%	53%	58%	53%	54%
Raja microocellata	2%	4%	3%	3%	4%	5%	5%	4%	7%	7%	11%	8%	9%
Raja brachyura	15%	11%	16%	13%	18%	19%	20%	27%	25%	22%	17%	22%	28%
Leucoraja circularis	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%
Raja montagui	10%	13%	19%	8%	9%	10%	10%	7%	6%	8%	5%	7%	4%
Leucoraja naevus	2%	3%	3%	3%	3%	2%	3%	1%	5%	2%	1%	3%	1%
Dipturus oxyrinchus	6%	5%	1%	4%	3%	5%	3%	8%	3%	4%	4%	4%	1%
Rajidae	17%	16%	16%	15%	19%	4%	6%	0%	0%	0%	0%	0%	0%
	Trawl												
	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Raja miraletus	1%	0%	1%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%
Raja clavata	64%	60%	47%	66%	71%	66%	76%	77%	71%	64%	73%	65%	62%
Raja microocellata	0%	0%	2%	0%	0%	0%	2%	0%	3%	1%	0%	0%	0%
Raja brachyura	8%	12%	13%	5%	6%	8%	8%	7%	10%	14%	15%	24%	25%
Leucoraja circularis	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Raja montagui	10%	11%	17%	8%	11%	12%	4%	4%	8%	12%	7%	7%	9%
Leucoraja naevus	7%	6%	8%	8%	6%	4%	5%	5%	7%	8%	5%	3%	2%
Dipturus oxyrinchus	3%	6%	3%	8%	1%	8%	4%	6%	0%	1%	1%	0%	2%
Rajidae	7%	5%	7%	5%	3%	2%	0%	0%	0%	0%	0%	0%	0%

Table 19.6. Skates in the Bay of Biscay and Iberian Waters. LPUE (kg day^{-1}) of the *L. naevus* and R. *clavata* caught by the Basque Country OTB DEF >= 70 and OTB DEF = 100 (Bottom otter trawl) in Subarea 8.

Year	*L. naevus*	*R. clavata*
2001	112	27
2002	91	16
2003	136	19
2004	120	21
2005	134	23
2006	140	24
2007	169	29
2008	137	24
2009	84	18
2010	44	14
2011	115	25
2012	33	21
2013	72	18
2014	79	19
2015	130	28
2016	119	32
2017	58	54
2018	51	41
2019	50	13

Table 19.7. Skates in the Bay of Biscay and Iberian Waters. Life-history information. Biological parameter estimates available for skate species inhabiting Portuguese Iberian waters. Growth models: VBR – von Bertalanffy Growth Model; GG – Gompertz Growth Model.

Species	TL range (cm)	L50 (cm) F	L50 (cm) M	l50 (years) F	l50 (years) M	Fecundity	Reproductive period	Growth model	Growth parameters estimates						Period	Region	Source
									L∞ (cm)	k (y–1)	t0 (years)	Lmax (cm)	lmax (years)	l∞ longevity (years)			
R. undulata	19.4–88.2	76.2	73.6	8.98	7.66	-	-	VBG	110.2	0.11	–1.58	88.2	13	-	1999–2001	Algarve	[1,2]
	23.7–90.5	83.8	78.1	9	8	-	Feb–May	VBG	113.7	0.15	–0.01	90.5	12	23.6	2003–2006	Centre	[3]
	32.0–83.2	-	-	-	-	-	-	VBG	119.3	0.12	–0.41	83.2	9	28.9	1999–2001	Algarve	[3]
	23.5–95.9	86.2 ±2.6	76.8 ±2.4	8.7 ±0.3	7.6 ±0.4	69.8 ±3.4	Dec–May	-	-	-	-	-	-	-	2003–2013	North /Centre	[4]
R. clavata	14.3–91.3	-	-	-	-		-	VBG	128.0	0.112	–0.62	91.3	10	-	2003–2007	All	[5]
	12.5–105.0	78.4	67.6	7.5	5.8	136	May–Jan		-	-	-	-	-	-	2003–2008	All	[6]
R. brachyura	37.4–106.1	97.9	88.8	-	-	-	Mar–Jul	VBG	110.51	0.12	0.26	106.1	-	-	2003–2004	All	[7]
	37.6–108.8	96.6	88.6	-	-		Mar–Jul		-	-	-	-	-	-	2003–2012	North /Centre	[10]
R. montagui	25.2–76.1	59.4	50.4	-	-	-	Apr–Jun	VBG	75.9	0.23	0.16	76.1	7	-	2003–2004	All	[8]
	36.8–70.2	56.7	48.0	-	-		Apr-Jul	-	-	-	-	-	-	-	2003–2012	All	[10]
L. naevus	12.7–71.8	55.6	56.5	-	-		-	VBG	79.2	0.24	0.12	71.8	-	-	2003–2004	All	[7]
	13.3–71.8	56.5	56.0	-	-	63	Jan-May		-	-	-	-	-	-	2003–2010	All	[9]

[1] Coelho and Erzini, 2002; [2] Coelho and Erzini, 2006; [3] Moura *et al.*, 2008; [4] Serra-Pereira et al., 2015; [5] Serra-Pereira *et al.*, 2008; [6] Serra-Pereira *et al.*, 2011; [7] Farias, 2005; [8] Serra-Pereira, 2005; [9] Maia *et al.*, 2012; [10] Pina Rodrigues, 2012.

Table 19.8a. Results from the combined length distribution of *R. clavata* from the polyvalent fleet, in Portugal mainland (Division 9.a), for multiple years (2008–2019) from the LBI method.

	Conservation				Optimizing Yield	MSY
	L_c/L_{mat}	$L_{25\%}/L_{mat}$	$L_{max5\%}/L_{inf}$	P_{mega}	L_{mean}/L_{opt}	$L_{mean}/L_{F=M}$
Ref	**>1**	**>1**	**>0.8**	**>30%**	**~1**	**≥1**
2008	0.61	0.68	0.66	0.00	0.74	0.93
2009	0.61	0.68	0.67	0.00	0.77	0.97
2010	0.67	0.75	0.67	0.00	0.78	0.93
2011	0.61	0.71	0.69	0.00	0.78	0.99
2012	0.67	0.70	0.68	0.00	0.78	0.93
2013	0.67	0.72	0.69	0.00	0.79	0.95
2014	0.67	0.76	0.70	0.00	0.80	0.96
2015	0.73	0.77	0.72	0.01	0.84	0.95
2016	0.48	0.75	0.71	0.02	0.78	1.11
2017	0.73	0.78	0.70	0.00	0.84	0.95
2018	0.67	0.73	0.72	0.02	0.81	0.97
2019	0.67	0.76	0.72	0.01	0.81	0.97

Table 19.8b. Results from the combined length distribution of *R. montagui* from the polyvalent fleet, in Portugal mainland (Division 9.a), for multiple years (2008–2019) from the LBI method.

	Conservation				Optimizing Yield	MSY
	L_c/L_{mat}	$L_{25\%}/L_{mat}$	$L_{max5\%}/L_{inf}$	P_{mega}	L_{mean}/L_{opt}	$L_{mean}/L_{F=M}$
Ref	**>1**	**>1**	**>0.8**	**>30%**	**~1**	**≥1**
2008	0.66	0.84	0.73	0.02	0.85	1.03
2009	0.87	0.89	0.79	0.08	0.95	0.97
2010	0.87	0.96	0.84	0.32	1.01	1.04
2011	0.56	0.87	0.79	0.05	0.88	1.16
2012	0.87	0.87	0.78	0.04	0.91	0.94
2013	0.56	0.89	0.78	0.04	0.89	1.17
2014	0.93	0.91	0.82	0.07	0.99	0.98
2015	0.66	0.89	0.76	0.04	0.89	1.07
2016	0.61	0.91	0.82	0.11	0.95	1.19
2017	0.56	0.94	0.92	0.12	0.95	1.26
2018	0.98	0.98	0.77	0.03	0.98	0.93
2019	0.82	0.91	0.78	0.09	0.93	0.99

Table 19.8c. Results from the combined length distribution of *R. brachyura* from the polyvalent fleet, in Portugal mainland (Division 9.a), for multiple years (2008–2019) from the LBI method.

	Conservation				Optimizing Yield	MSY
	L_c/L_{mat}	$L_{25\%}/L_{mat}$	$L_{max5\%}/L_{inf}$	P_{mega}	L_{mean}/L_{opt}	$L_{mean}/L_{F=M}$
Ref	>1	>1	>0.8	>30%	~1	≥1
2008	0.57	0.63	0.77	0.06	0.75	0.96
2009	0.63	0.61	0.70	0.01	0.69	0.85
2010	0.57	0.64	0.75	0.04	0.76	0.98
2011	0.63	0.68	0.77	0.08	0.83	1.02
2012	0.39	0.69	0.77	0.05	0.78	1.20
2013	0.63	0.68	0.76	0.05	0.81	0.99
2014	0.57	0.68	0.78	0.07	0.82	1.06
2015	0.63	0.74	0.79	0.12	0.88	1.08
2016	0.69	0.74	0.78	0.08	0.86	0.99
2017	0.69	0.77	0.79	0.09	0.87	1.01
2018	0.69	0.70	0.78	0.07	0.83	0.97
2019	0.69	0.74	0.77	0.07	0.84	0.98

Table 19.9. Skates in the Bay of Biscay and Iberian Waters. Annual estimates of the posterior median, 25% and 97.5% quartiles of the total landed weight of *Raja undulata* for the period 2003–2008 along the Portuguese mainland (Division 9.a)

Year	median	P2.5	P97.5
2003	164.3	137.1	197.0
2004	197.0	164.2	235.8
2005	171.7	141.2	208.4
2006	271.3	232.6	315.1
2007	156.7	132.3	185.6
2008	208.3	178.4	243.4

Table 19.10. Skates in the Bay of Biscay and Iberian Waters. *Raja undulata* CPUE: results of the zero-truncated Poisson regression analysis on the full model, containing both variables, year (2016–2018) and quarter (1–4).

Coefficients:	Estimate	Std. Error	z-value	Pr(>|z|)
(YEAR)2016	2.07573	0.03677	56.45	<2e-16***
(YEAR)2017	1.68566	0.03018	55.85	<2e-16***
(YEAR)2018	2.00571	0.02811	71.34	<2e-16***
(QUARTER)2	0.49734	0.03343	14.88	<2e-16***
(QUARTER)3	0.36449	0.03282	11.11	<2e-16***
(QUARTER)4	0.25755	0.03416	7.54	4.7e-14***

Table 19.11. *Raja undulata* potential catches estimates in Portugal mainland (Division 9.a) by region and vessel size category for 2017. Official landed weight (in ton) in each region is also presented.

Region	Official landed weight (ton)	Vessel size Category	Potential total captured number	Potential total captured weight (ton)
North	14.3	>13	2393	9.2
		<13	3624	12.9
Center	2.0698	>12	167	0.4
		<12	8886	23.3
Southwest	9.1224	>10	299	1.6
		<10	10786	27.9
South	7.2303	>10	675	1.0
		<10	14021	41.2
Total	32.716		40851	117.3

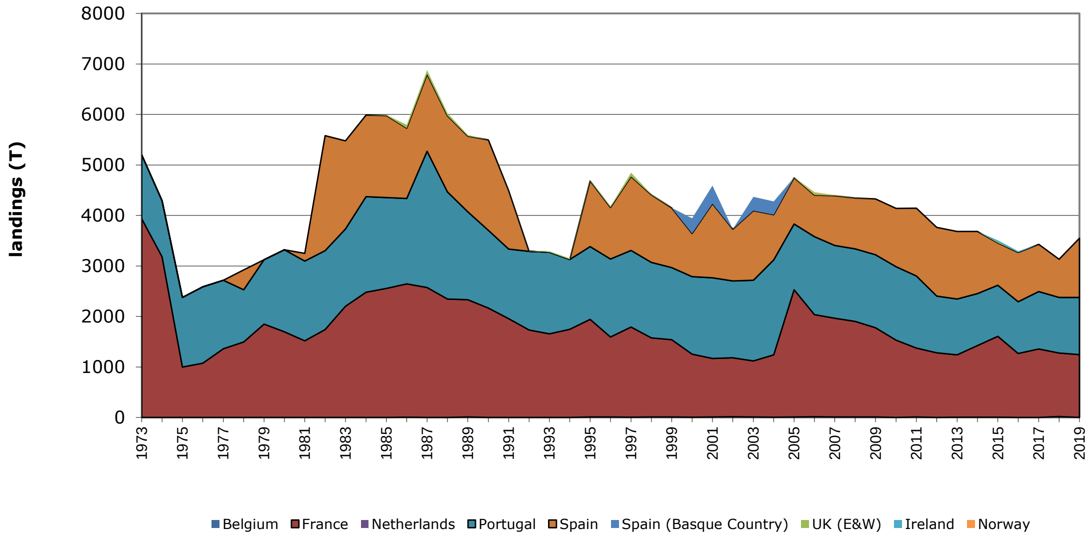


Figure 19.1. Skates in the Bay of Biscay and Iberian Waters. Historical trend in landings of Rajidae in Subarea 8 and Division 9.a since 1973.

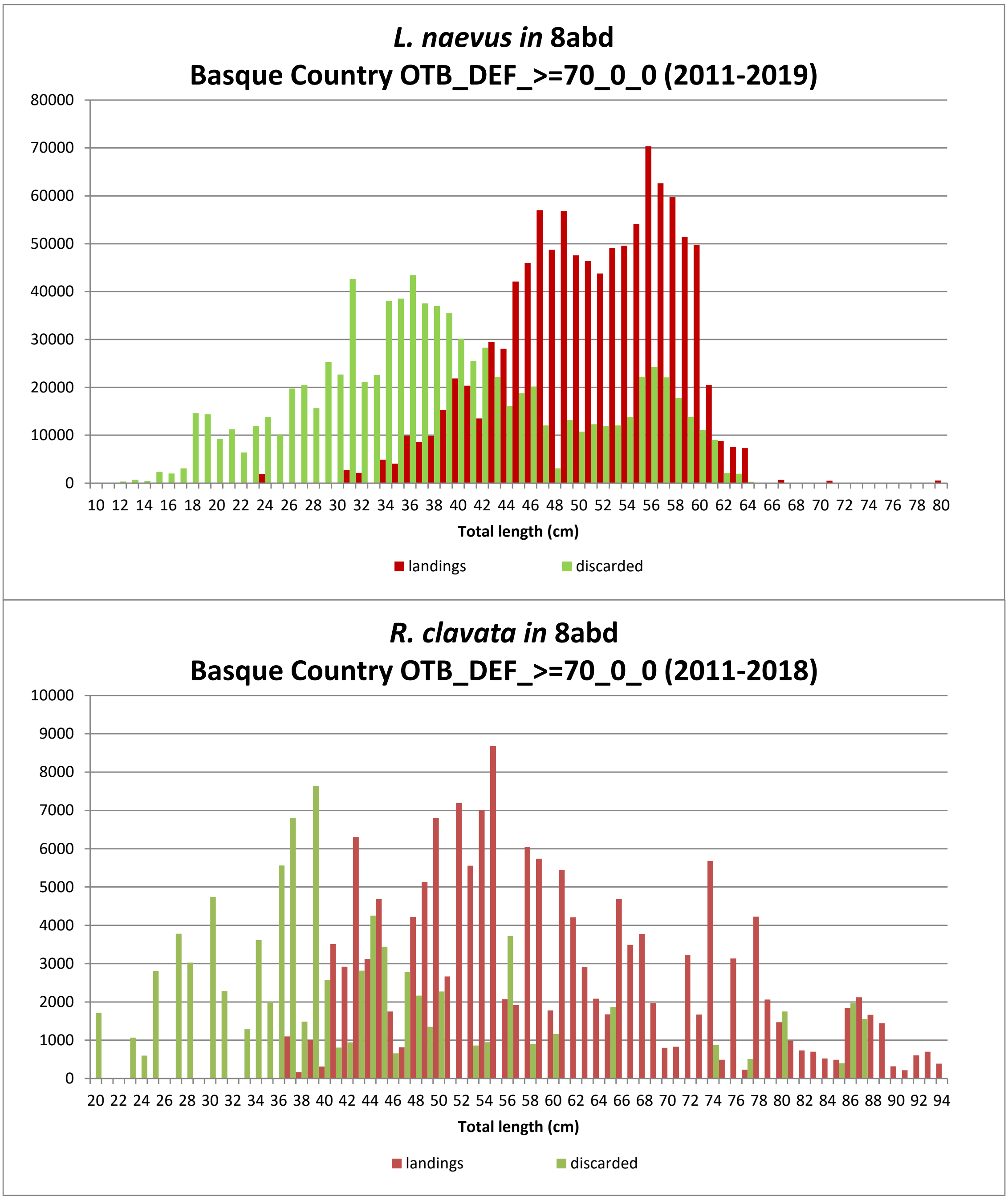


Figure 19.2a. Skates in the Bay of Biscay and Iberian Waters. Length–frequency distribution of the *Leucoraja naevus* and *Raja clavata* for the period from 2011–2019 of the Basque OTB (Bottom Otter Trawler).

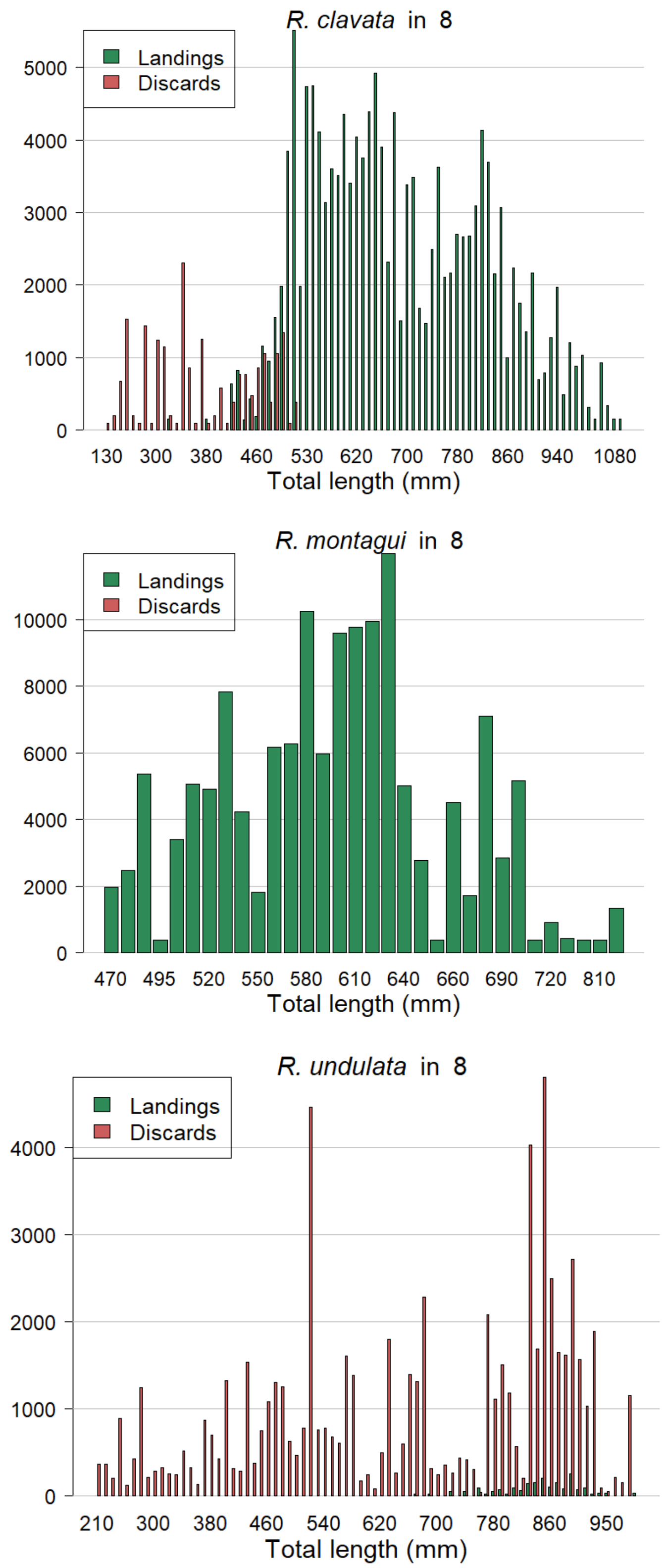


Figure 19.2b. Skates in the Bay of Biscay and Iberian Waters. Length–frequency distribution of *Raja clavata, R. montagui* and *R. undulata* by the commercial French fleet (bottom trawl and nets) for the period 2016–2020 in Subarea 8.

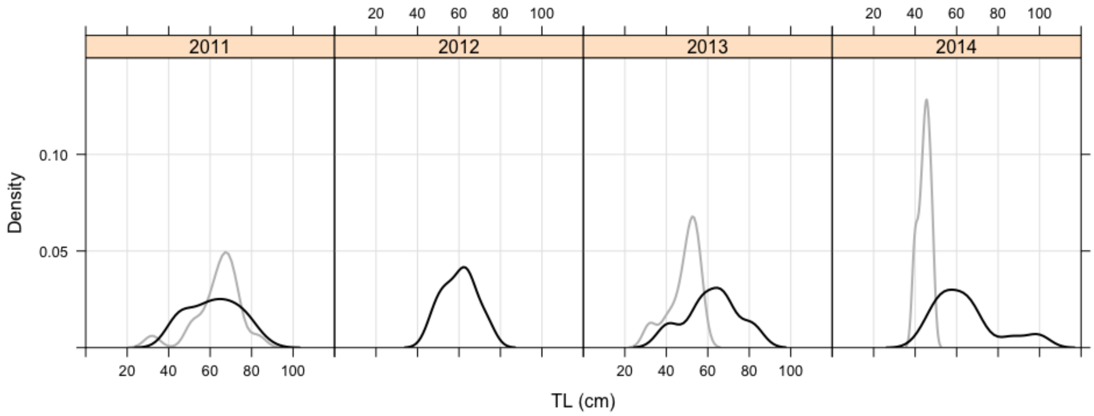


Figure 19.2c. Length frequency distribution of *R. clavata* retained (black) and discarded (grey) fractions observed onboard vessels with LOA >12 m and with fishing permit to operate with gillnets and/or trammel nets, between 2011 and 2014, in mainland Portugal (Division 9.a). The length frequencies were not raised to the total landings. n = 204 sampled individuals.

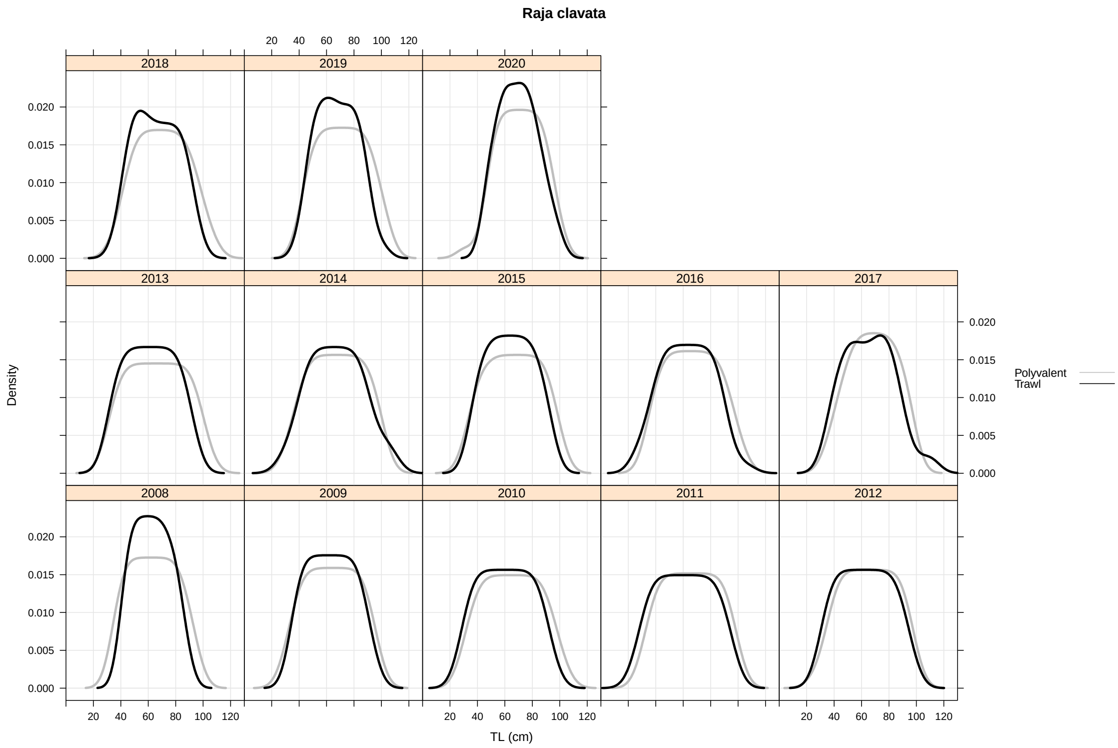


Figure 19.2d. Skates in the Bay of Biscay and Iberian Waters. Length–frequency distribution of *Raja clavata* for the period from 2008–2020 in mainland Portugal (Division 9.a). Total number of sampled trips was n = 2846 for the polyvalent segment and n = 837 for the trawl segment.

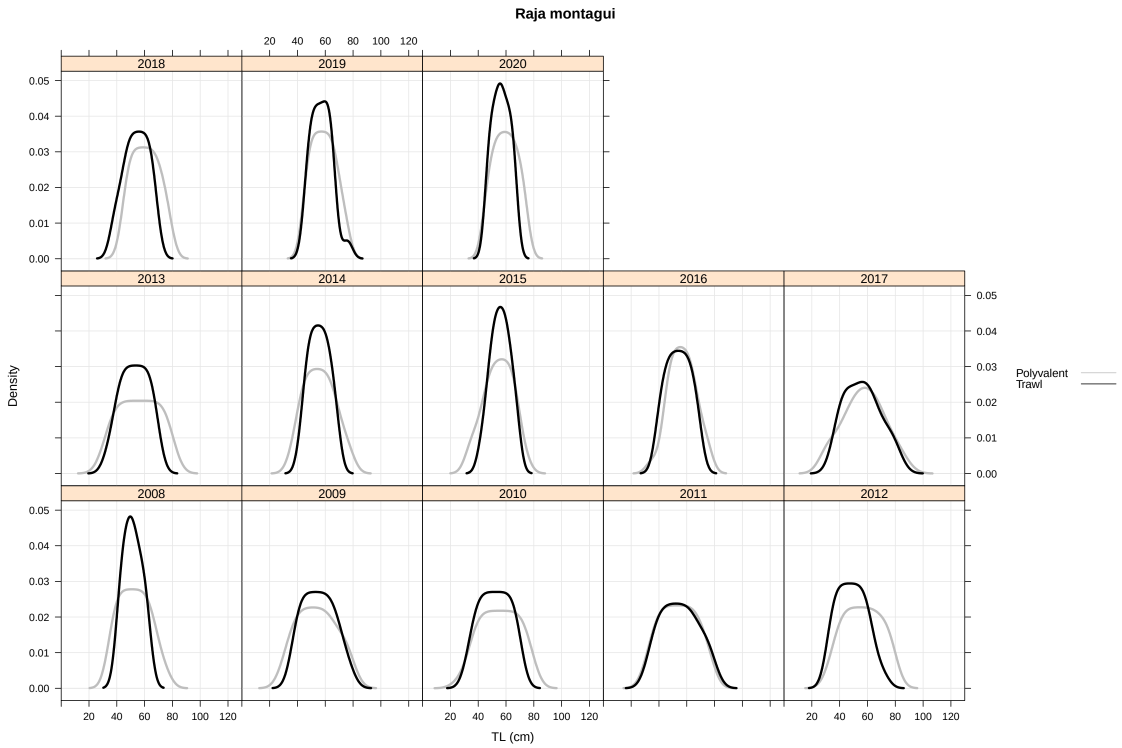


Figure 19.2e. Skates in the Bay of Biscay and Iberian Waters. Length–frequency distribution of *Raja montagui* for the period from 2008–2020 in mainland Portugal (Division 9.a). Total number of sampled trips was n = 1194 for the polyvalent segment and n = 417 for the trawl segment.

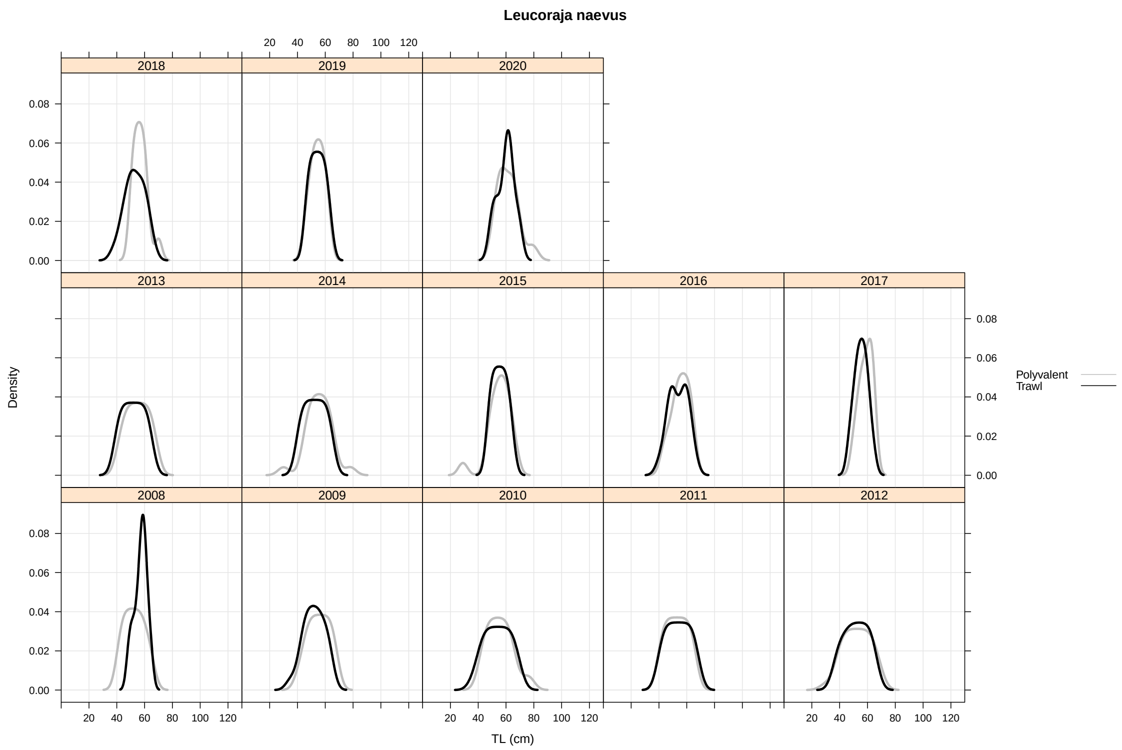


Figure 19.2f. Skates in the Bay of Biscay and Iberian Waters. Length–frequency distribution of *Leucoraja naevus* for the period from 2008–2020 in mainland Portugal (Division 9.a). Total number of sampled trips was n = 317 for the polyvalent segment and n = 191 for the trawl segment.

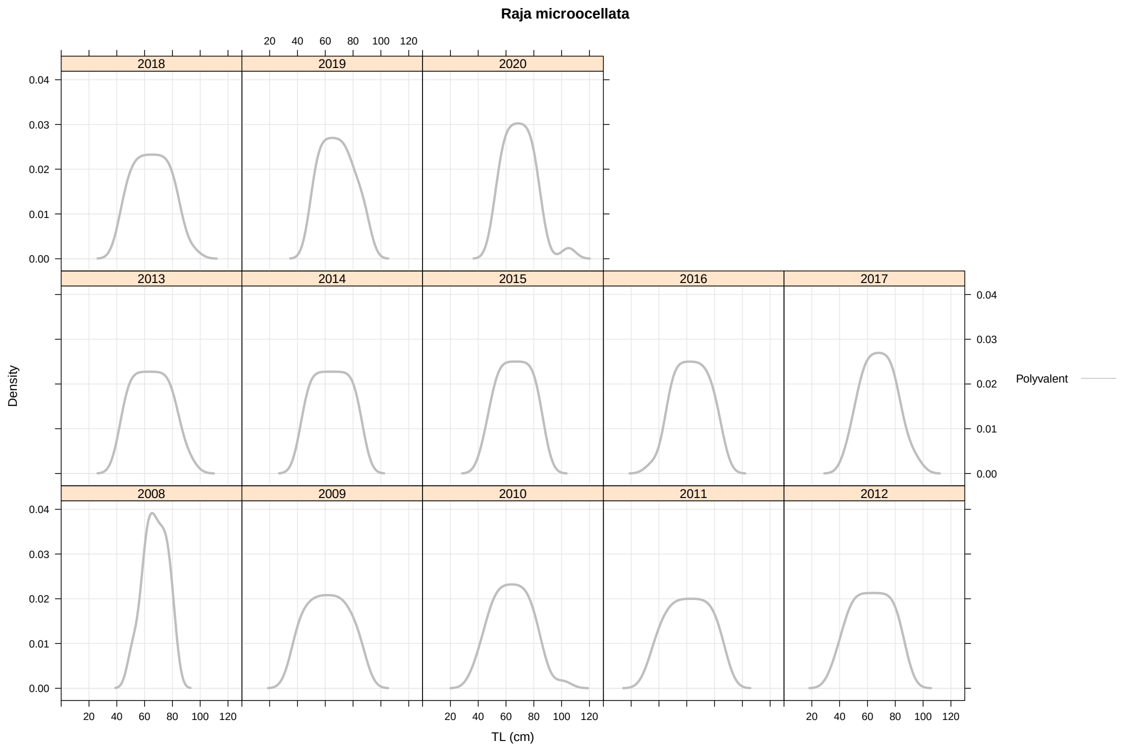


Figure 19.2g. Skates in the Bay of Biscay and Iberian Waters. Length–frequency distribution of *Raja microocellata* for the period from 2008–2020 in mainland Portugal (Division 9.a). Total number of sampled trips was n = 763 for the polyvalent segment.

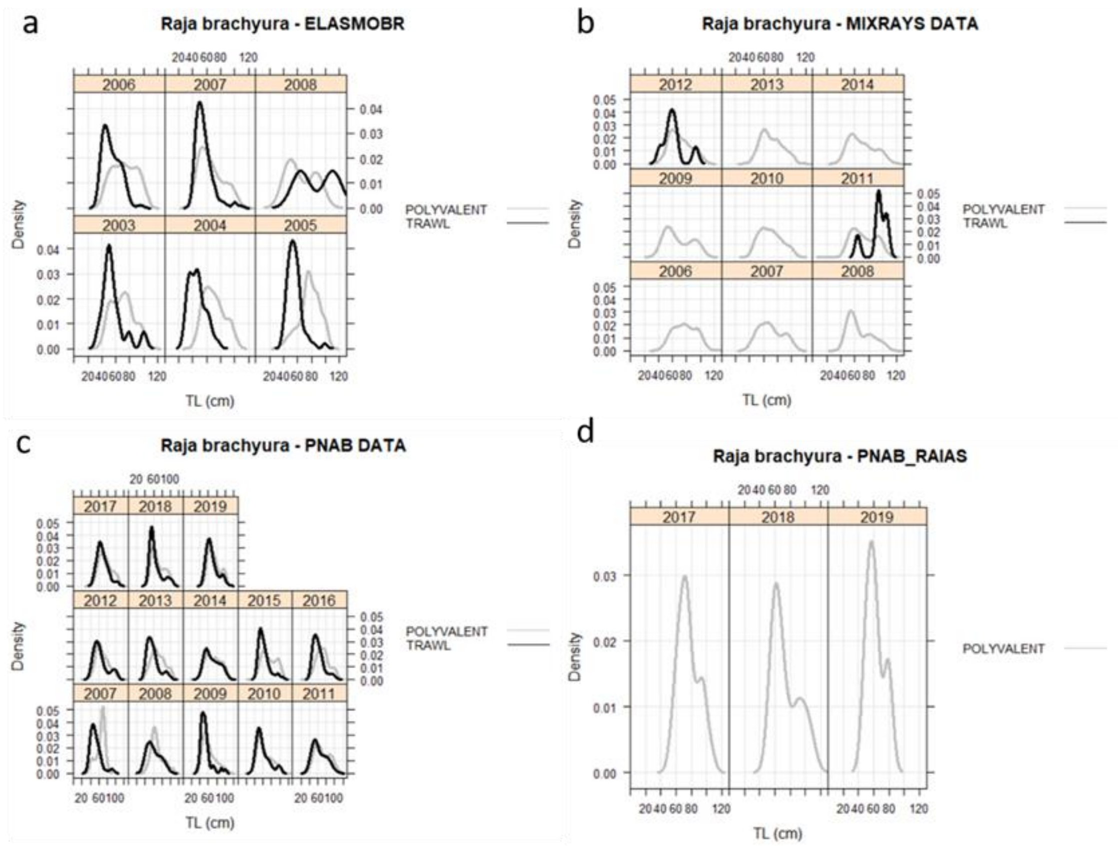


Figure 19.2h. Skates in the Bay of Biscay and Iberian Waters. Annual density plots of length of *R. brachyura* by segment for the different data sources: a) ELASMOBR; b) MIXRAYS; c) PNAB and; d) PNAB RAYS.

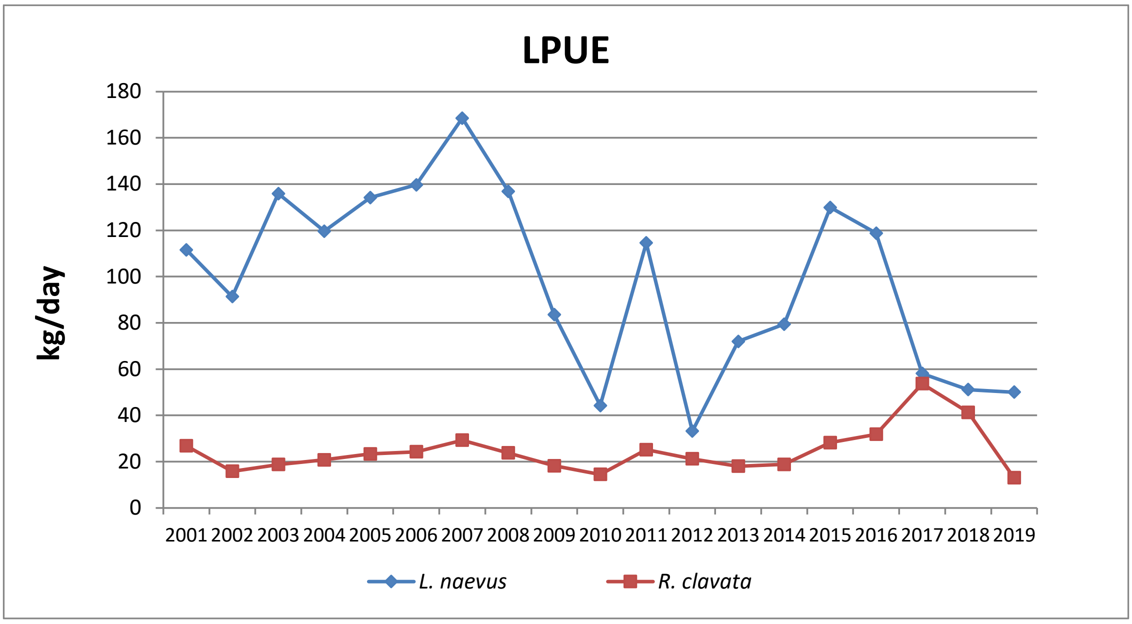


Figure 19.3. Skates in the Bay of Biscay and Iberian Waters. Nominal LPUE (kg day^{-1}) of *Leucoraja naevus* and *Raja clavata* caught in the OTB DEF >= 70 Basque fleet in Subarea 8 (2001–2019).

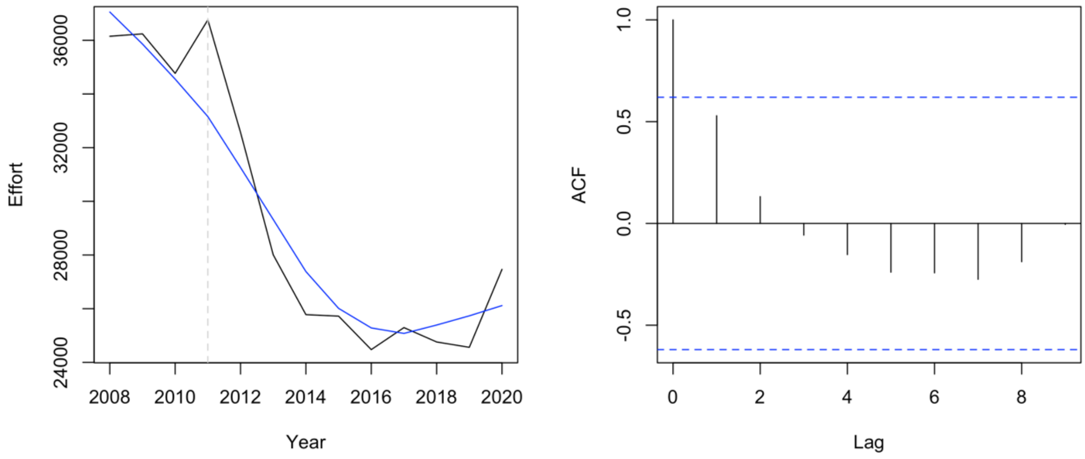


Figure 19.4a. Skates in the Bay of Biscay and Iberian Waters. Fishing effort time series (number of trips) with lowess smooth (in blue; left) and autocorrelation (ACF; right) for all skates and rays combined, caught by the polyvalent fleet in mainland Portugal (Division 9.a). The grey vertical line in the left plot indicates the threshold of the last 10 years of the time series, for which the Mann-Kendall trend test and the ACF were estimated.

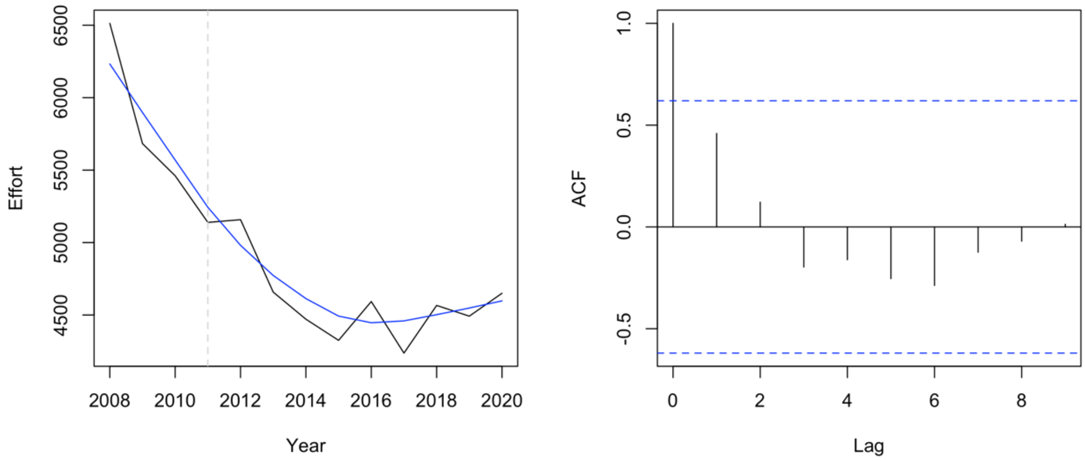


Figure 19.4b. Skates in the Bay of Biscay and Iberian Waters. Fishing effort time series (number of trips) with lowess smooth (in blue; left) and autocorrelation (ACF; right) for all skates and rays combined, caught by the trawl fleet in mainland Portugal (Division 9.a). The grey vertical line in the left plot indicates the threshold of the last 10 years of the time series, for which the Mann-Kendall trend test and the ACF were estimated.

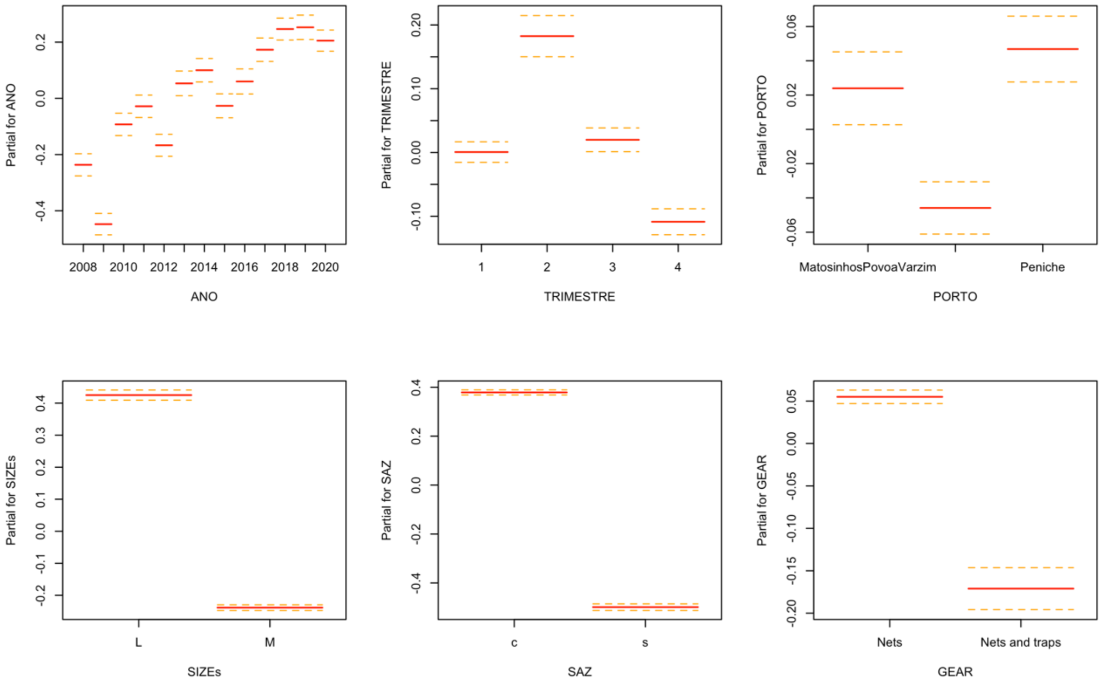


Figure 19.4c. Skates in the Bay of Biscay and Iberian Waters. Effect of each explanatory variable included in the standardization of the LPUE for *R. clavata* caught by the polyvalent segment in mainland Portugal (Division 9.a): year, quarter, landing port, vessel size ("SIZEs"), fishing seasonality ("SAZ") and fishing gear (trammel nets or gillnets).

Figure 19.4d. Skates in the Bay of Biscay and Iberian Waters. Standardized LPUE from the polyvalent segment in mainland Portugal vs standardized PtGFS-WIBTS-Q4 Survey biomass Index for *R. clavata* (Division 9.a). Both series are normalized to the long-term mean and present the standard errors in shade.

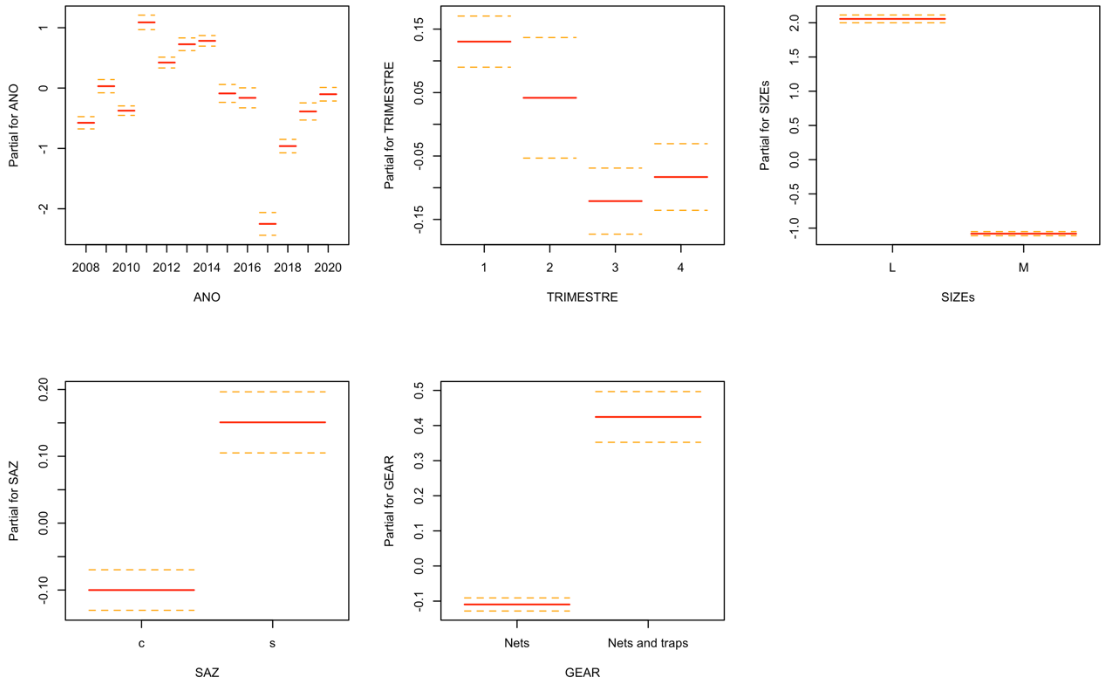


Figure 19.4e. Skates in the Bay of Biscay and Iberian Waters. Effect of each explanatory variable included in the standardization of the LPUE for *L. naevus* caught by the polyvalent segment in mainland Portugal (Division 9.a): year, quarter, landing port, vessel size ("SIZEs"), fishing seasonality ("SAZ") and fishing gear (trammel nets or gillnets).

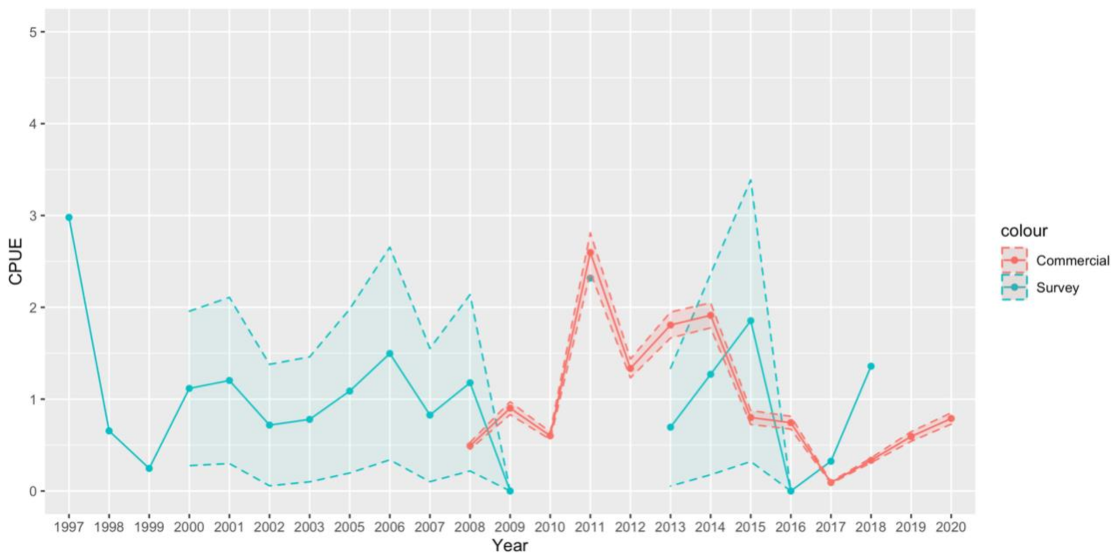


Figure 19.4f. Skates in the Bay of Biscay and Iberian Waters. Standardized LPUE from the polyvalent segment in mainland Portugal vs standardized NepS (FU 28–29) Survey biomass Index for *L. naevus* (Division 9.a). Both series are normalized to the long-term mean and present the standard errors in shade.

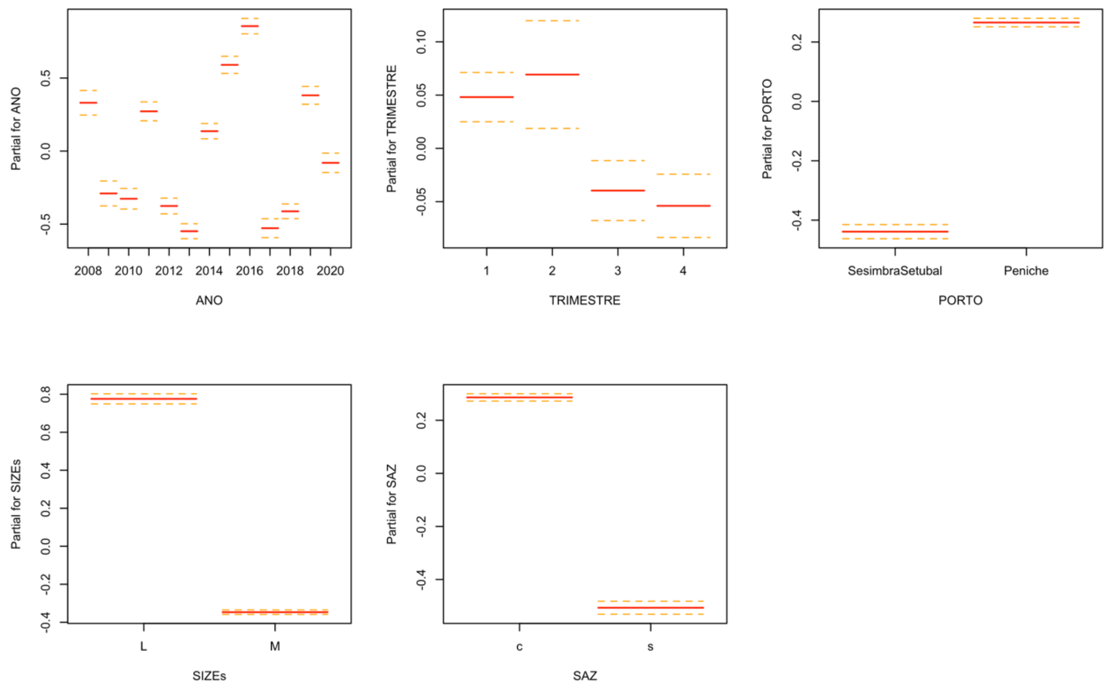


Figure 19.4g. Skates in the Bay of Biscay and Iberian Waters. Effect of each explanatory variable included in the standardization of the LPUE for *R. montagui* caught by the polyvalent segment in mainland Portugal (Division 9.a): year, quarter, landing port, vessel size ("SIZEs"), fishing seasonality ("SAZ") and fishing gear (trammel nets or gillnets).

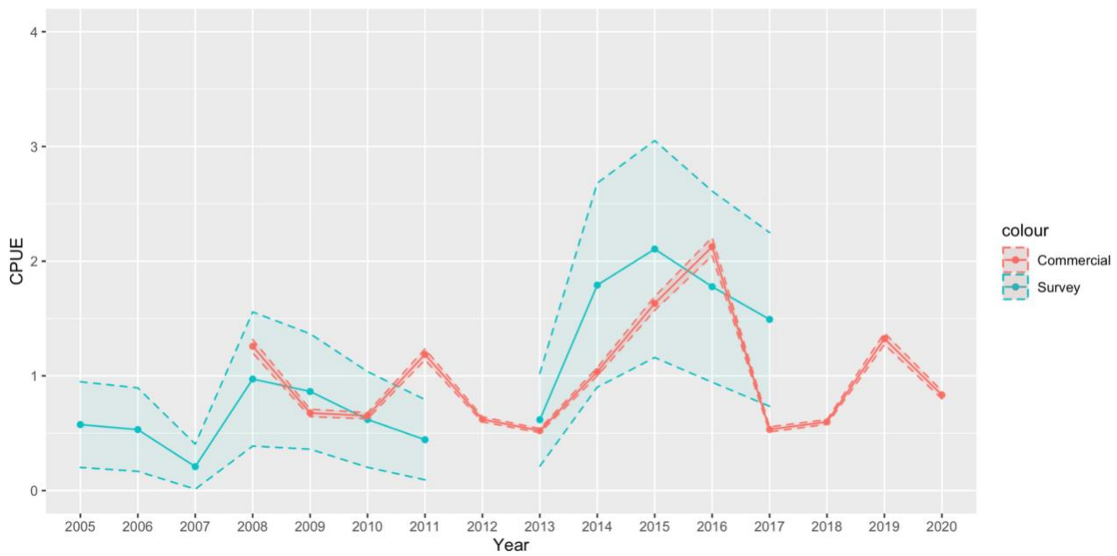


Figure 19.4h. Skates in the Bay of Biscay and Iberian Waters. Standardized LPUE from the polyvalent segment in mainland Portugal vs standardized PtGFS-WIBTS-Q4 Survey biomass Index for *R. montagui* (Division 9.a). Both series are normalized to the long-term mean and present the standard errors in shade.

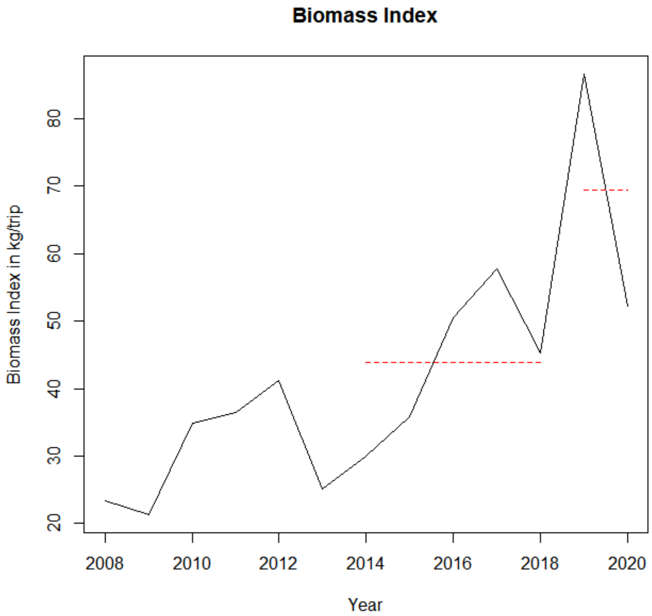


Figure 19.4i. Skates in the Bay of Biscay and Iberian Waters. Annual standardized CPUE estimates (kg trip^{-1}) of *R. brachyura* in the Division 9.a of the Portuguese Polyvalent fleet for the period 2008–2020.

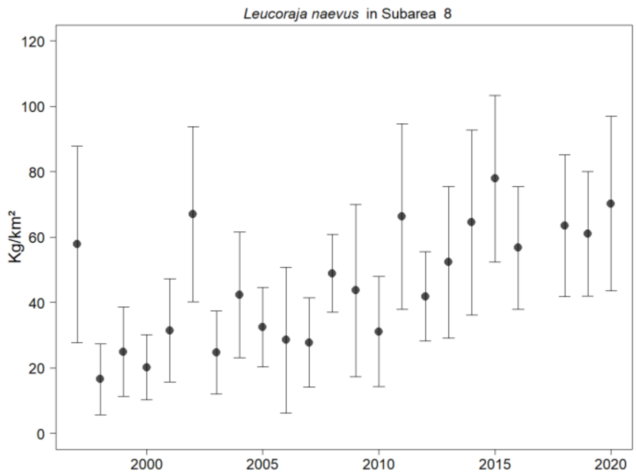


Figure 19.5a. Skates in the Bay of Biscay and Iberian Waters. Biomass indices 1987 index (kg km^{-2}) of *L. naevus* from the EVHOE survey 1997–2020 in divisions 8.abd.

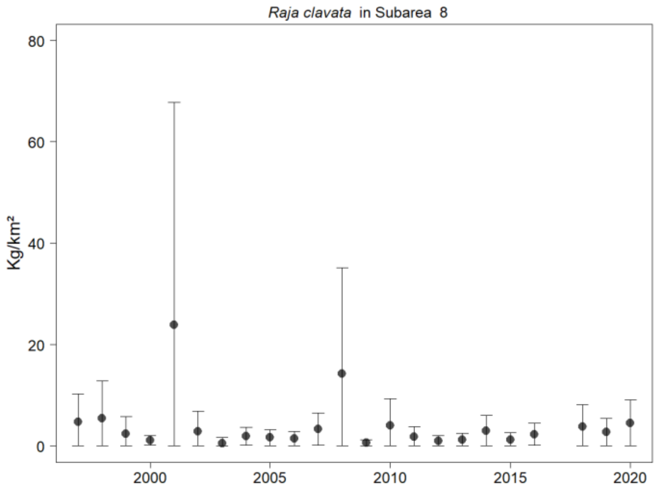


Figure 19.5b. Skates in the Bay of Biscay and Iberian Waters. Biomass indices index (kg km^{-2}) of *R. clavata* from the EVHOE survey, 1997–2020 in divisions 8.abd.

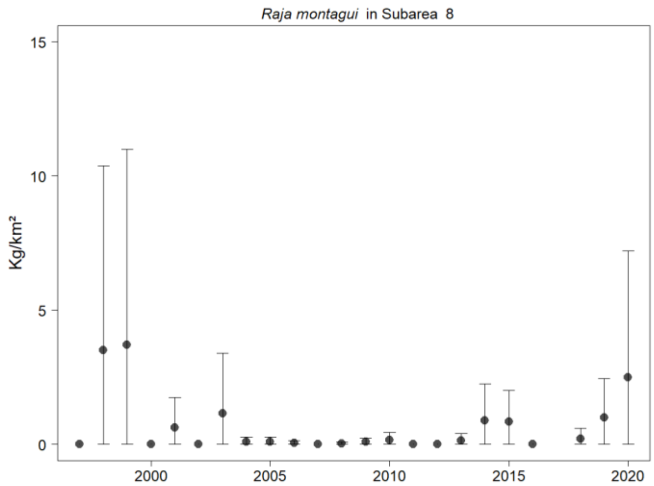


Figure 19.6c. Skates in the Bay of Biscay and Iberian Waters. Biomass indices index (kg km^{-2}) of *R. montagui* from the EVHOE survey, 1997–2020 in divisions 8.abd.

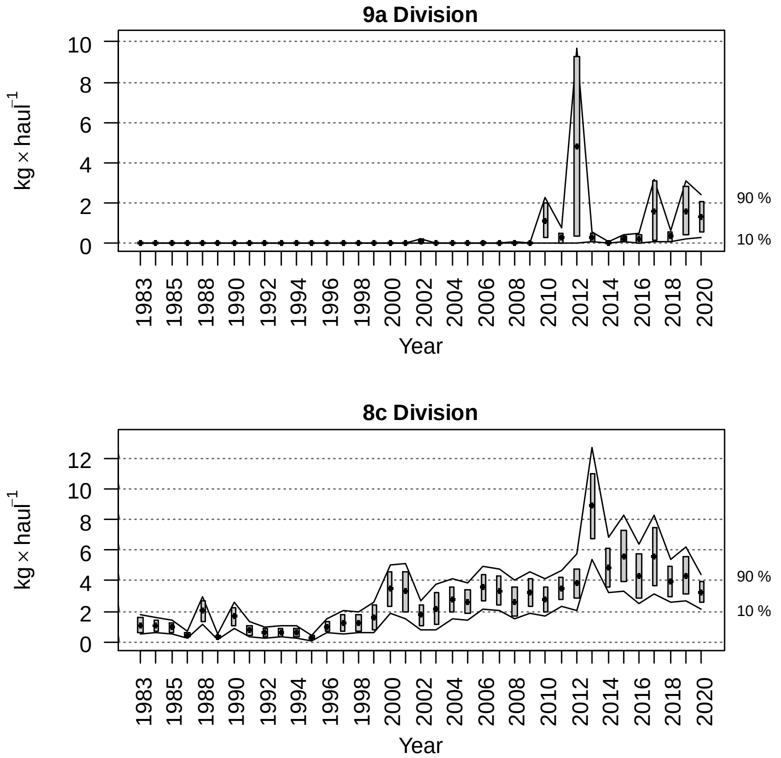


Figure 19.6a. Skates in the Bay of Biscay and Iberian waters. Time-series of *Raja clavata* biomass indices, in ICES divisions 9.a and 8.c, during the North Spanish bottom trawl survey (1983–2020). Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α = 0.80, bootstrap iterations = 1000).

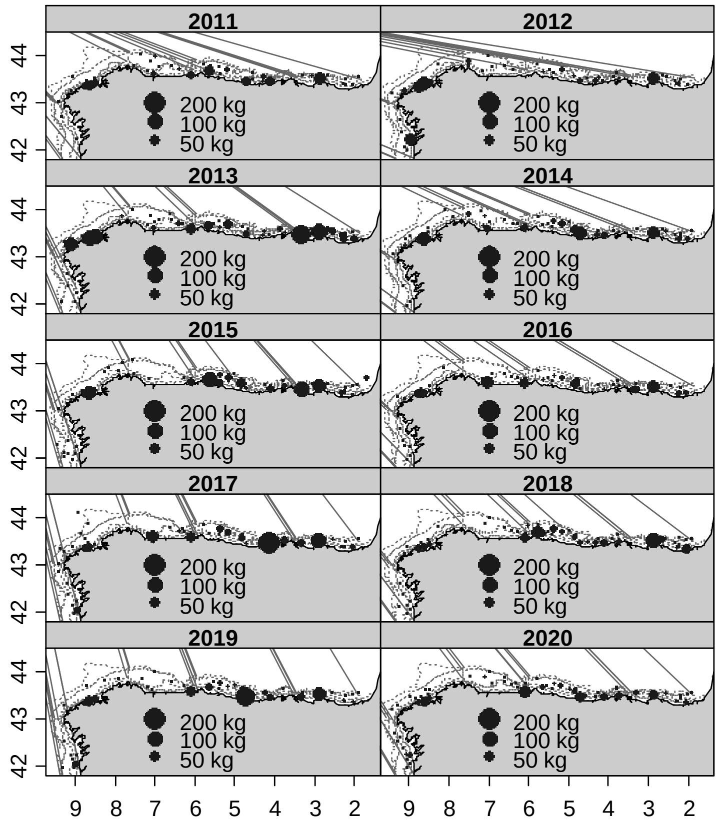


Figure 19.6b. Skates in the Bay of Biscay and Iberian waters. Geographical distribution of *R. clavata* catches (kg/30 min haul) in North Spanish continental shelf from bottom trawl surveys for the period (2011–2020).

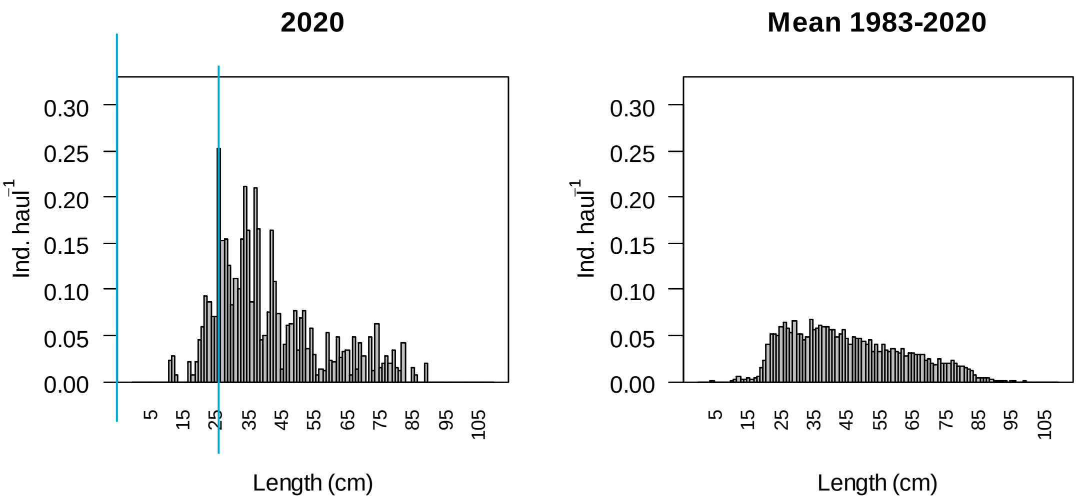
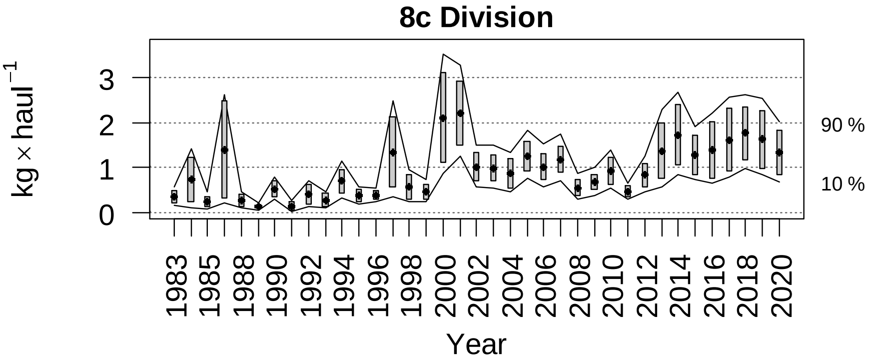


Figure 19.6c. Skates in the Bay of Biscay and Iberian waters. Stratified length distribution of *R. clavata* obtained from Spanish bottom trawl surveys time-series in the last survey (left) and in the period 1983–2020 (right) in Division 8.c of the North Spanish Shelf.



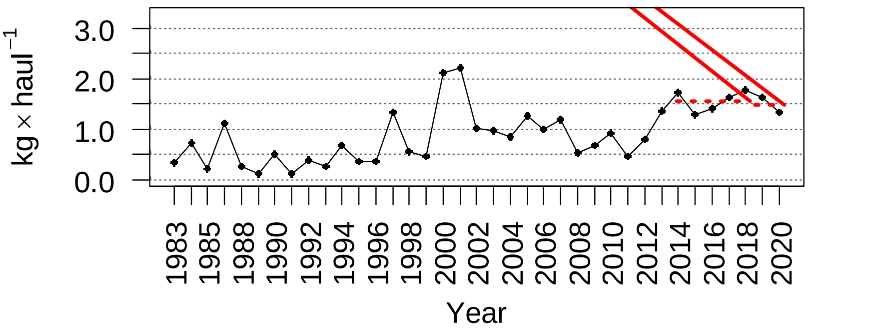


Figure 19.7a. Skates in the Bay of Biscay and Iberian Waters. Time-series of *Raja montagui* biomass index during North Spanish shelf bottom trawl survey (1983–2020) in Division 8.c covered by the survey. Top: boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (a = 0.80, bootstrap iterations = 1000). Bottom: red lines show the average index in the two last years and in the five previous.

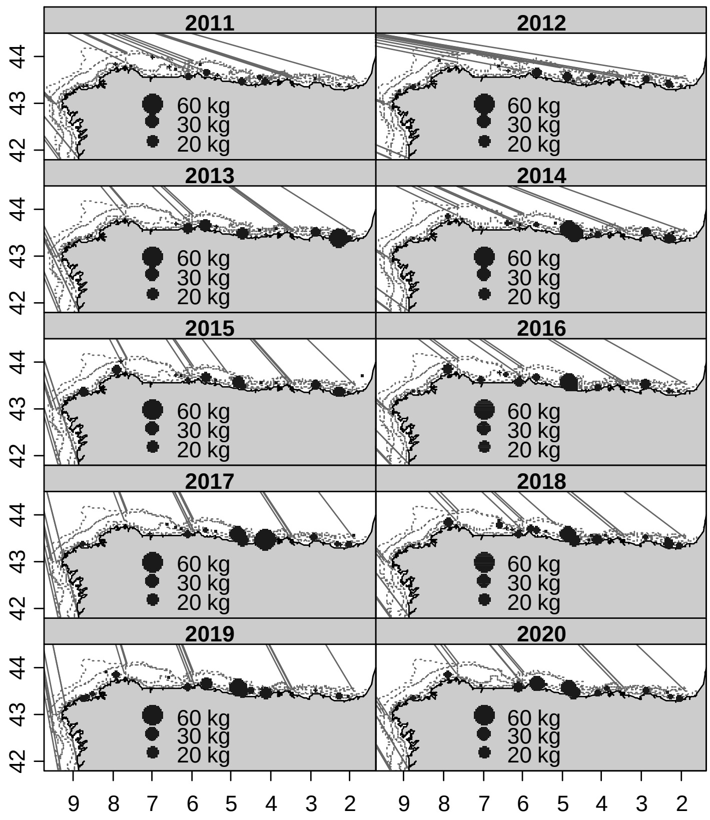


Figure 19.7b. Skates in the Bay of Biscay and Iberian Waters. Geographical distribution of *R. montagui* catches (kg/30 min haul) in North Spanish continental shelf bottom trawl surveys for the period (2011–2020).

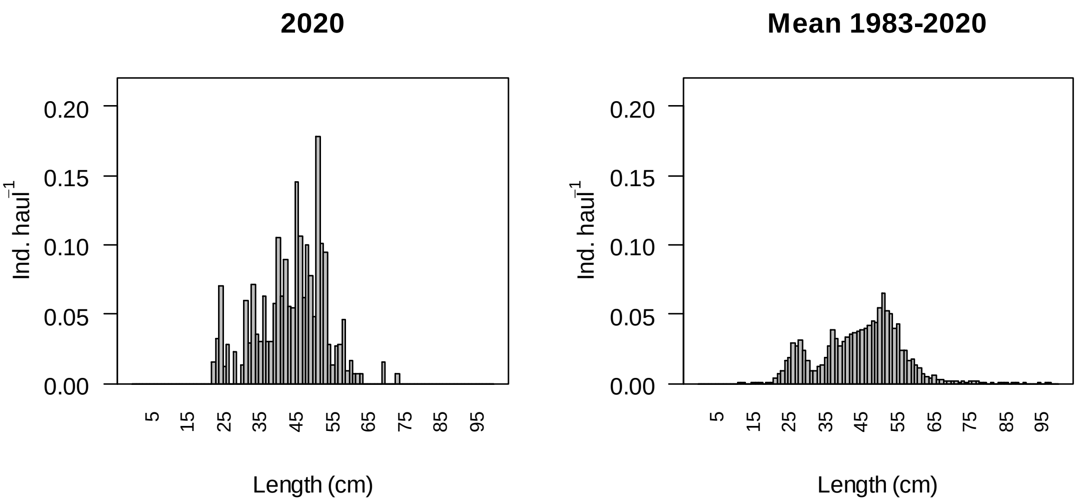
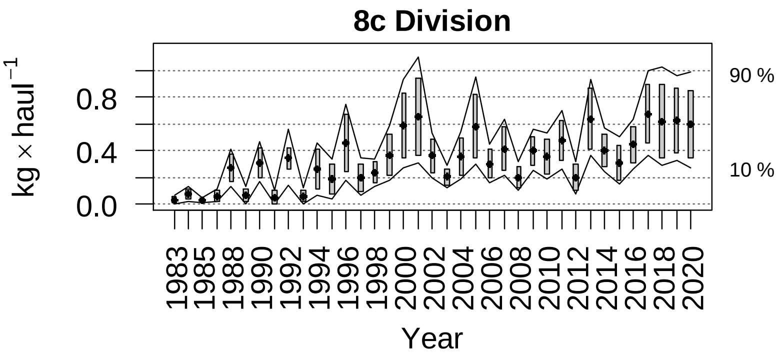


Figure 19.7c. Skates in the Bay of Biscay and Iberian waters. Mean stratified length distribution of *Raja montagui* in the last survey and in the period 1983–2020 (right) in Division 8.c of the North Spanish Shelf.



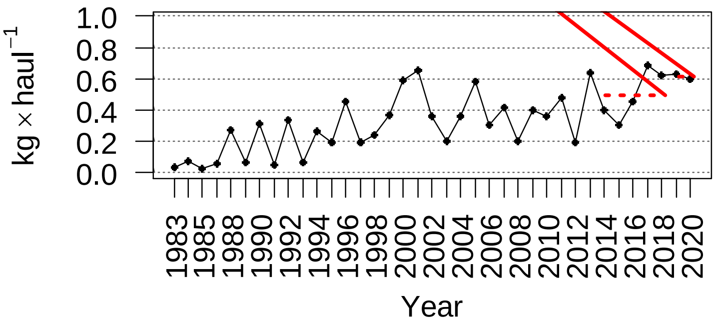


Figure 19.8a. Skates in the Bay of Biscay and Iberian Waters. Time-series of *Leucoraja naevus* biomass index during the North Spanish shelf bottom trawl survey (1983–2020) in ICES Division 8.c. Top: boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (a = 0.80, bootstrap iterations = 1000). Bottom: red lines show the average index in the two last years and in the five previous.

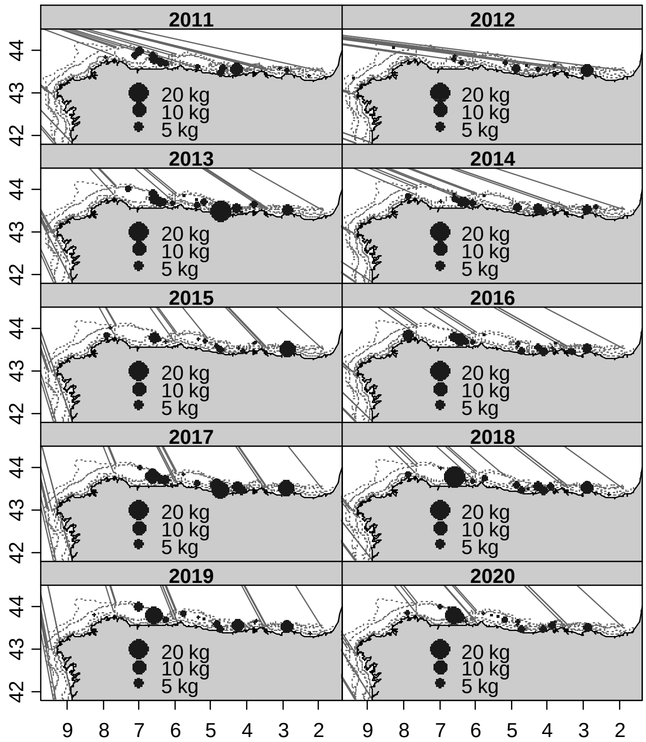


Figure 19.8b. Skates in the Bay of Biscay and Iberian Waters. Geographical distribution of *L. naevus* catches (kg/30 min haul) in North Spanish continental shelf bottom trawl surveys for the period (2011–2020).

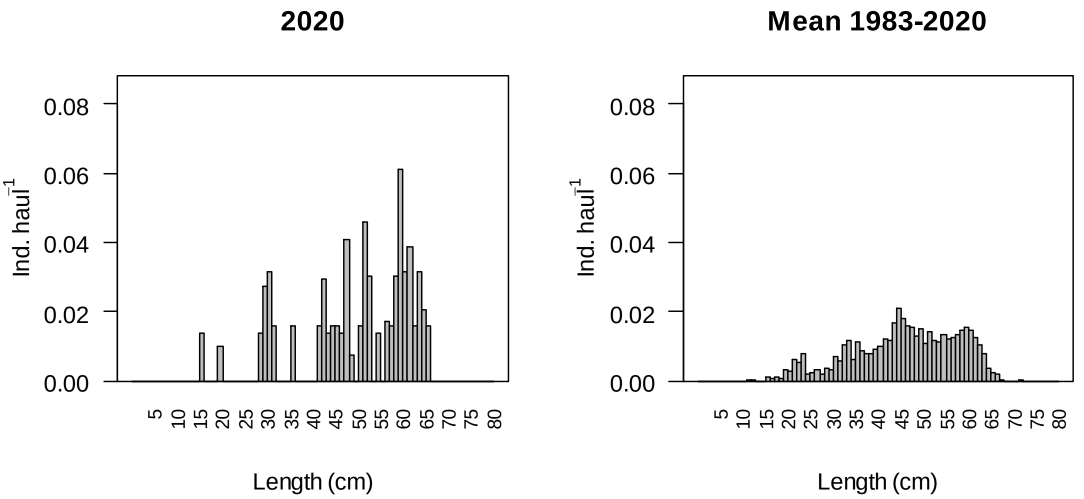


Figure 19.8c. Skates in the Bay of Biscay and Iberian waters. Mean stratified length distribution of *Leucoraja naevus* in the last survey (left) and in the period 1983–2020 (right) in Division 8.c of the North Spanish Shelf.

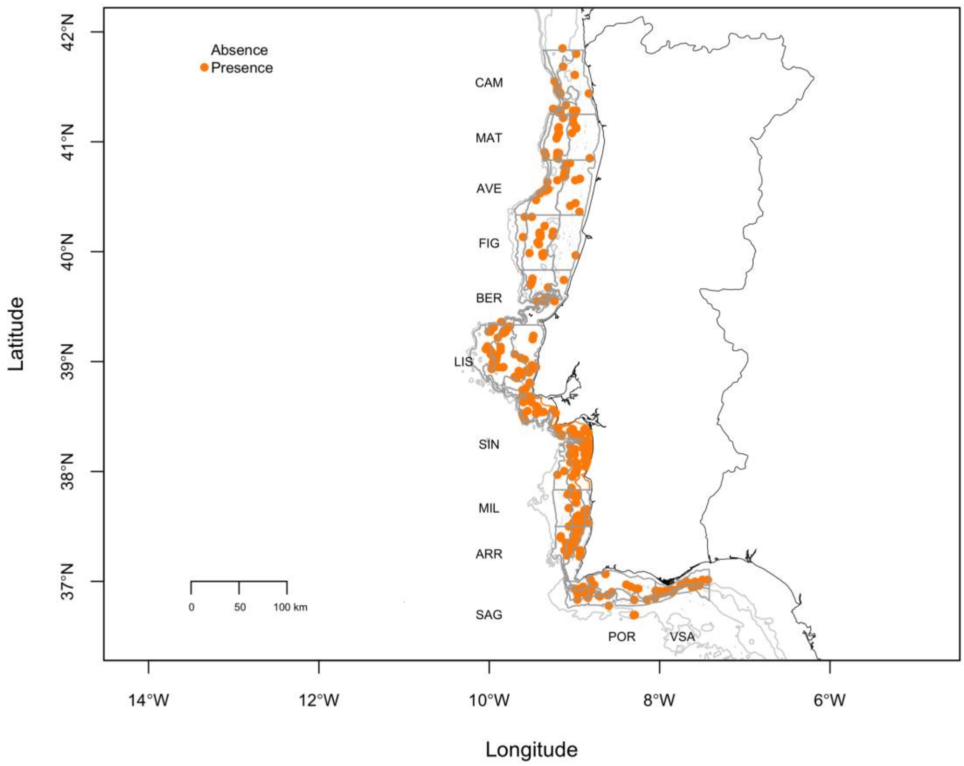


Figure 19.9a. Skates in the Bay of Biscay and Iberian Waters. *Raja clavata* distribution from 1981 to 2018 in the Portuguese Autumn Groundfish Survey (PtGFS-WIBTS-Q4).

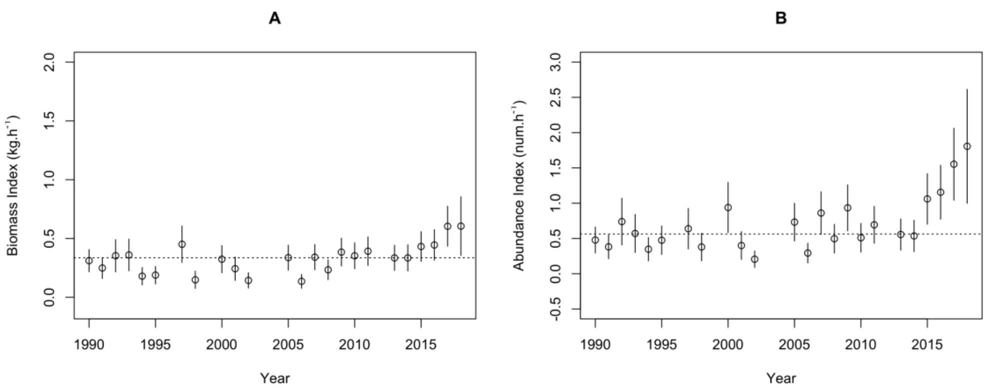


Figure 19.9b. Skates in the Bay of Biscay and Iberian Waters. *Raja clavata* A) biomass index (kg hour^{-1}) and B) abundance (ind.hour^{-1}) on PtGFS-WIBTS-Q4from 1990 to 2018. Dashed line represents the mean annual abundance for the considered period.

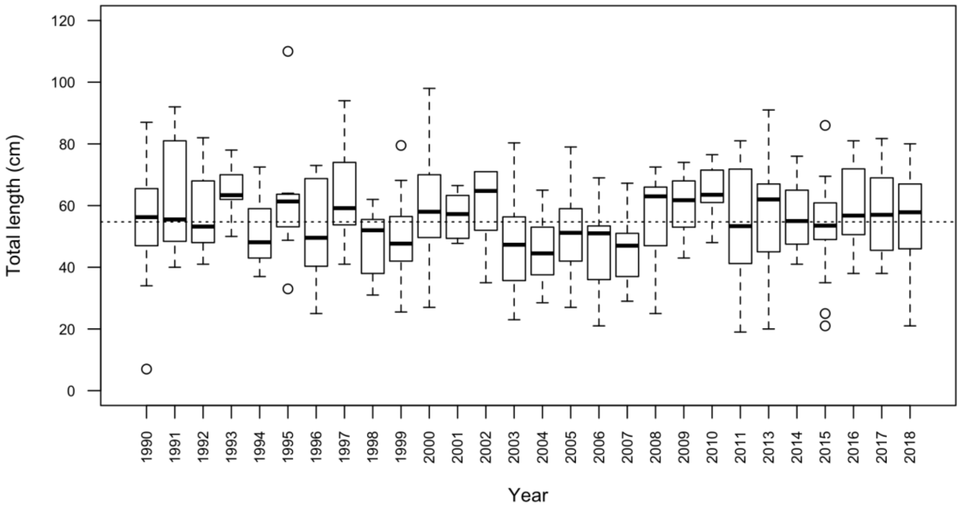


Figure 19.9c. Skates in the Bay of Biscay and Iberian Waters. Total length variation of *Raja clavata*, by year on PtGFS-WIBTS-Q4 (dashed line represents the mean annual length for 1990–2018).

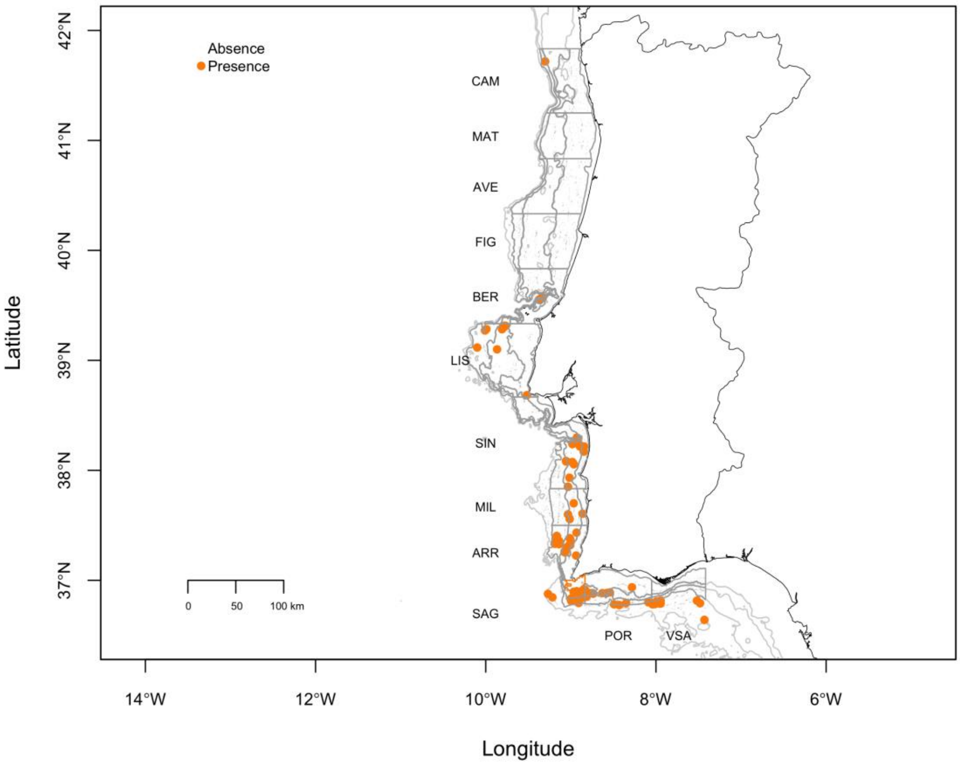


Figure 19.10a. Skates in the Bay of Biscay and Iberian Waters. *Leucoraja naevus* distribution from 1981 to 2018 in the Portuguese Autumn Groundfish Surveys (PtGFS-WIBTS-Q4), and Portuguese crustacean surveys/*Nephrops* TV surveys (PT-CTS (UWTV (FU 28-29).

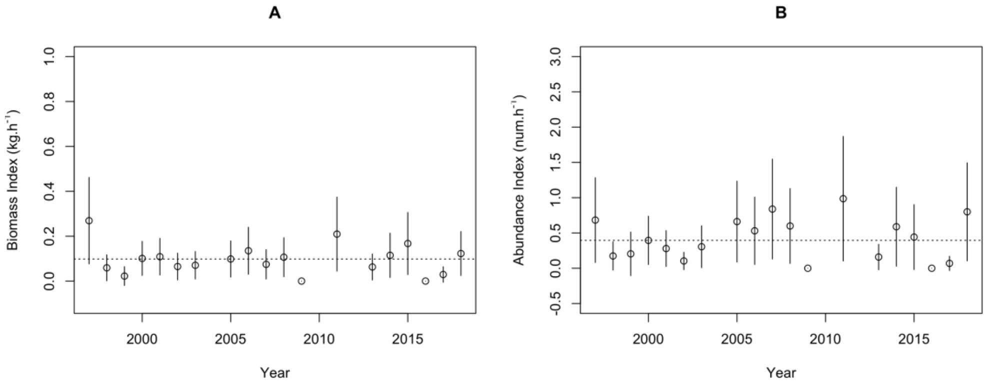


Figure 19.10b. Skates in the Bay of Biscay and Iberian Waters. *Leucoraja naevus* A) biomass index (kg hour^{-1}) and B) abundance (ind.hour^{-1}) on PT-CTS (UWTV (FU 28-29) from 1997 to 2018. Dashed line represents the mean annual abundance for the considered period.

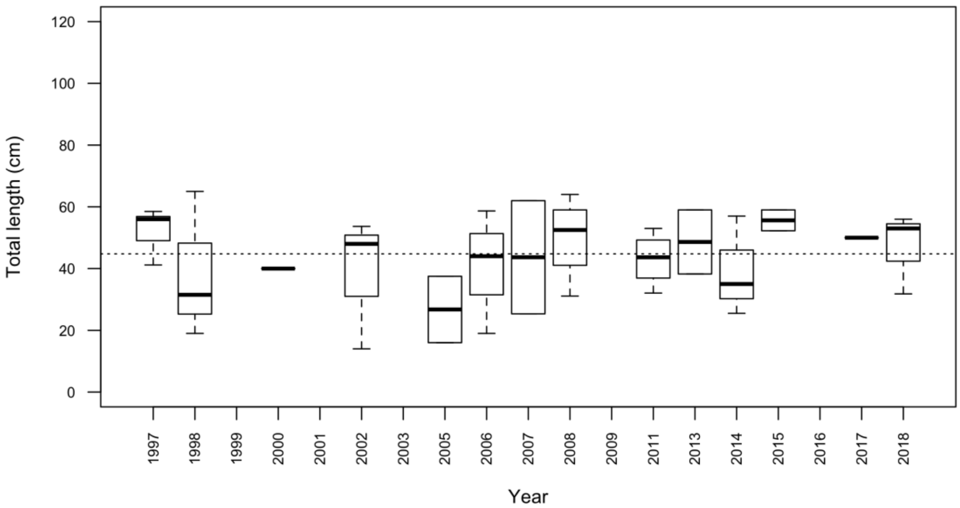


Figure 19.10c. Skates in the Bay of Biscay and Iberian Waters. Total length variation of *Leucoraja naevus*, by year on PT-CTS (UWTV (FU 28-29) (dashed line represents the mean annual length for 1997–2018).

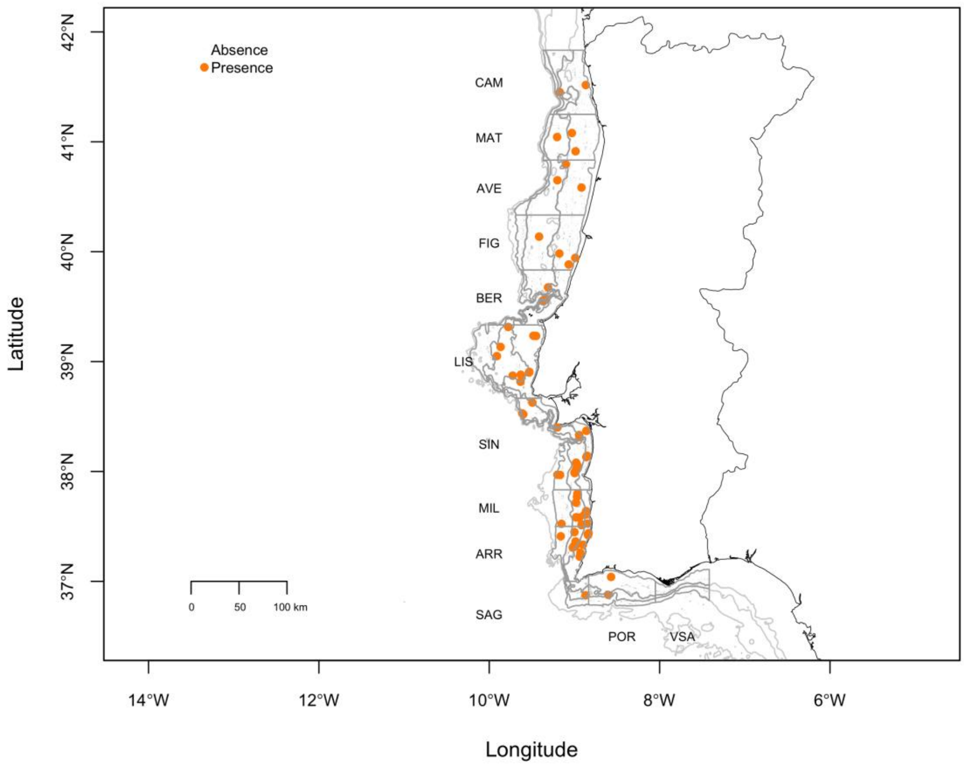


Figure 19.11a. Skates in the Bay of Biscay and Iberian Waters. *Raja montagui* distribution from 1981 to 2018 in the Portuguese Autumn Groundfish Surveys (PtGFS-WIBTS-Q4).

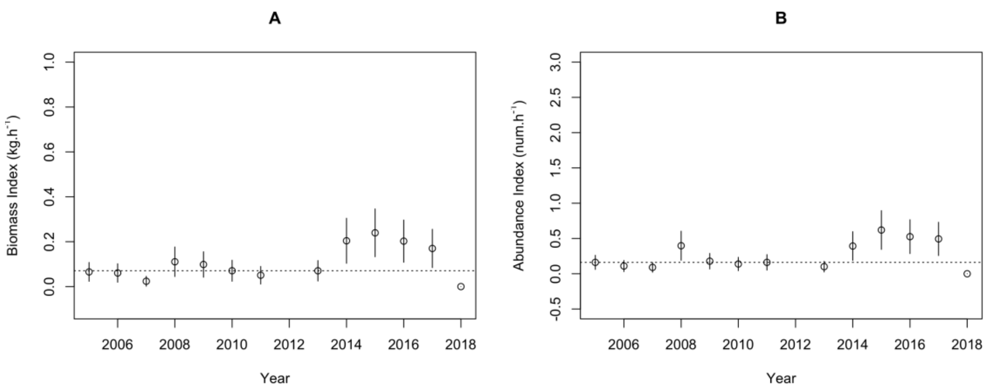


Figure 19.11b. Skates in the Bay of Biscay and Iberian Waters. *Raja montagui* biomass index (kg hour^{-1}) and abundance (ind. hour^{-1}) on PtGFS-WIBTS-Q4from 1990 to 2018. Dashed line represents the mean annual abundance for the considered period.

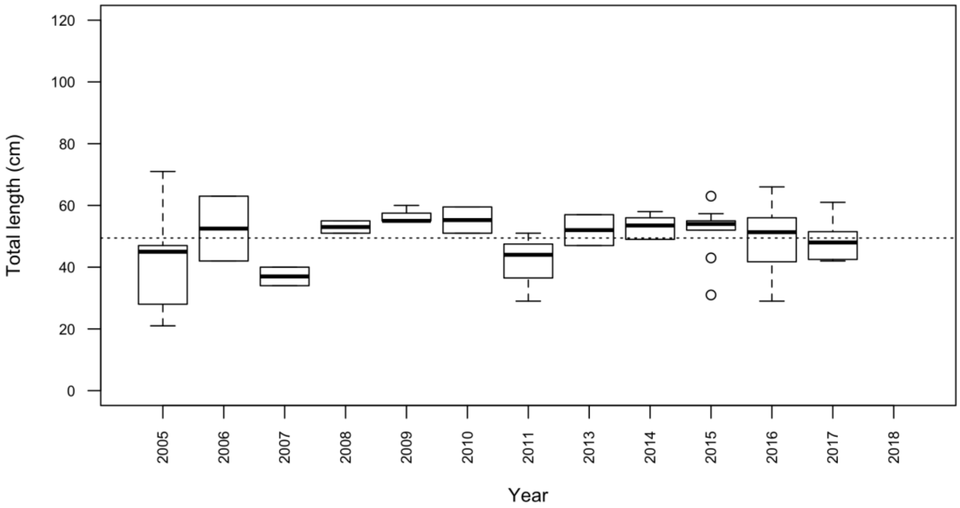


Figure 19.11c. Skates in the Bay of Biscay and Iberian Waters. Total length variation of *Raja montagui*, by year on PtGFS-WIBTS-Q4 (dashed line represents the mean annual length for 1990–2018).

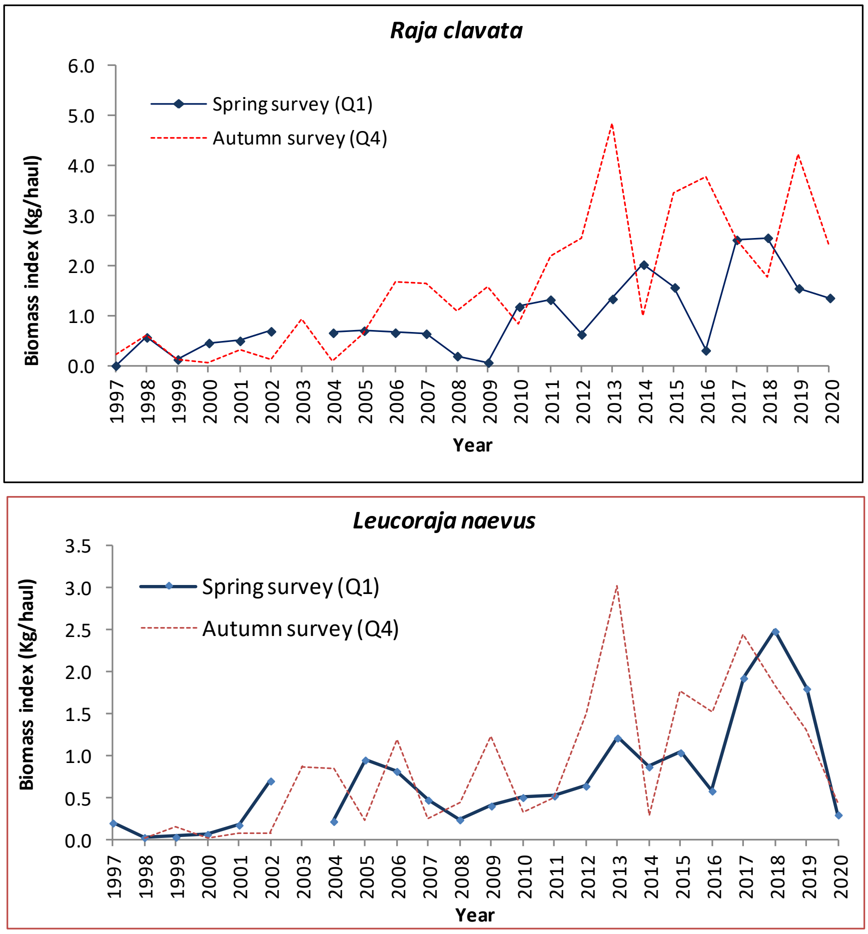


Figure 19.12a. Skates in the Bay of Biscay and Iberian Waters. Biomass index expressed as kg per haul of *R. clavata* (top) and *L. naevus* (below) from the Spanish bottom trawl surveys ARSA carried out in spring (Q1) and autumn (Q4) in the Gulf of Cadiz (ICES 9.a South) from 1997 to 2020.

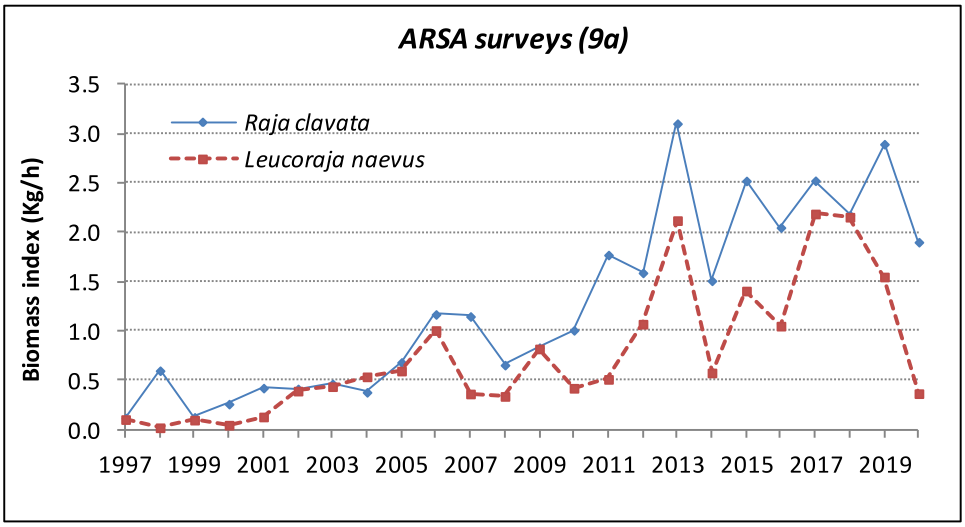


Figure 19.12b. Skates in the Bay of Biscay and Iberian Waters. Trend of the yield of *R. clavata* and *L. naevus* expressed as kg per haul from the Spanish bottom trawl survey ARSA carried out in spring and autumn in the Gulf of Cadiz (9.a South) from 1997 to 2020. The average of both surveys Q1 and Q4 has been represented.

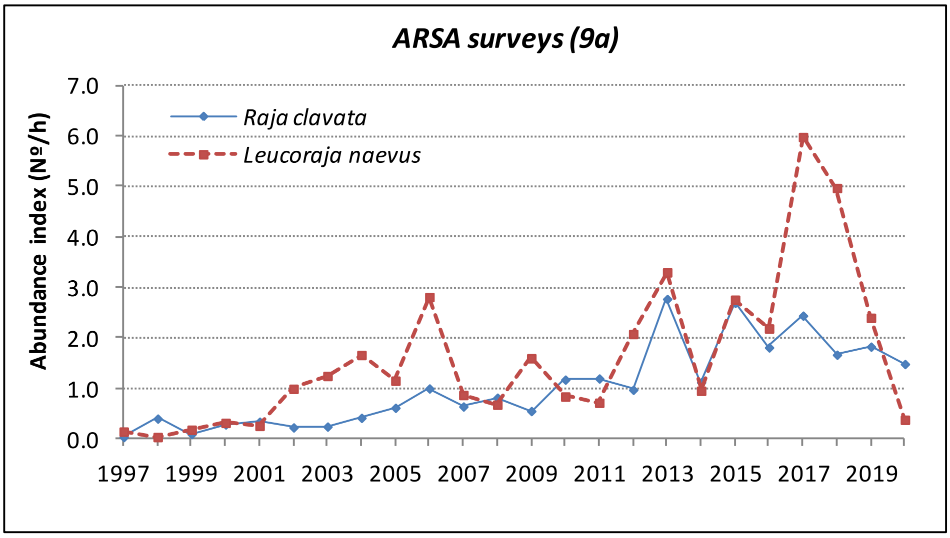


Figure 19.12c. Skates in the Bay of Biscay and Iberian Waters. Trend of the yield of *R. clavata* and *L. naevus* expressed as number per haul from the Spanish bottom trawl survey ARSA carried out in spring (Q1) and autumn (Q4) in the Gulf of Cadiz (9.a South) from 1997 to 2020. The average of both surveys Q1 and Q4 has been represented.

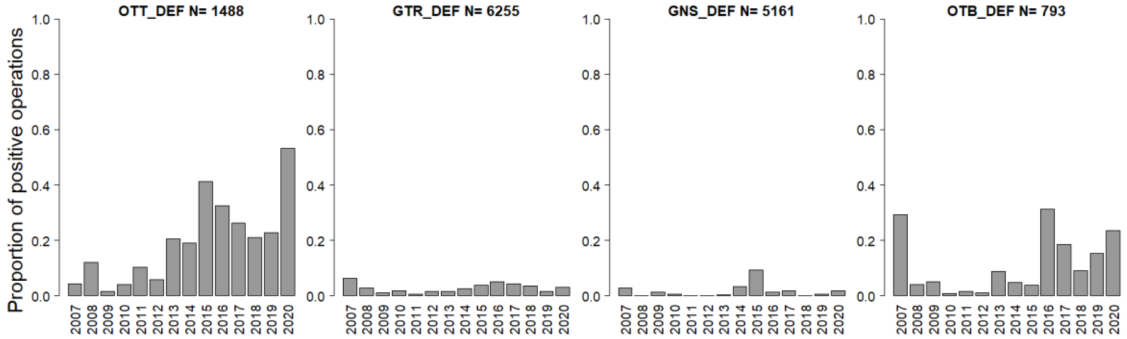


Figure 19.13a. Skates in the Bay of Biscay and Iberian Waters. *Raja clavata* in Subarea 8 (rjc.27.8). Occurrence indicators from the French on-board observer trips carried out in application of EU data collection programmes in 8abd. N: total number of fishing operations observed for the métier from 2007 to 2020.

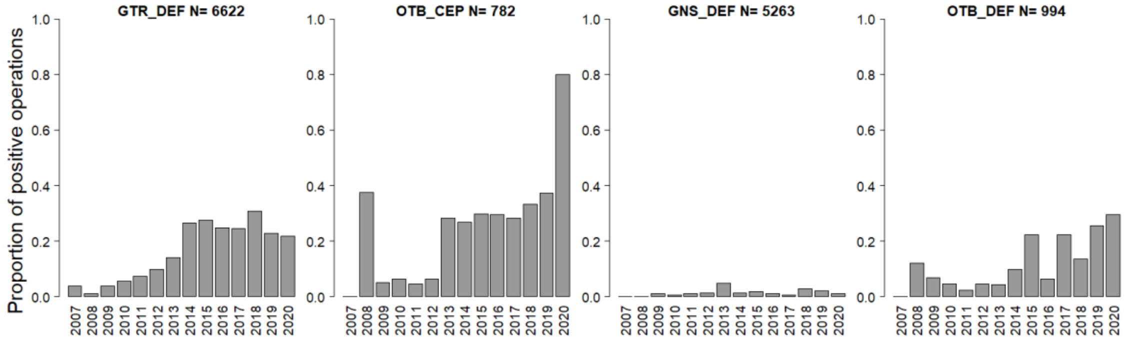


Figure 19.13b. Skates in the Bay of Biscay and Iberian Waters. *Raja undulata* in divisions 8.ab (rju.27.8ab). Occurrence indicators from the French on-board observer trips carried out in application of EU data collection programmes in 8.ab. N: total number of fishing operations observed by métier from 2007 to 2020.

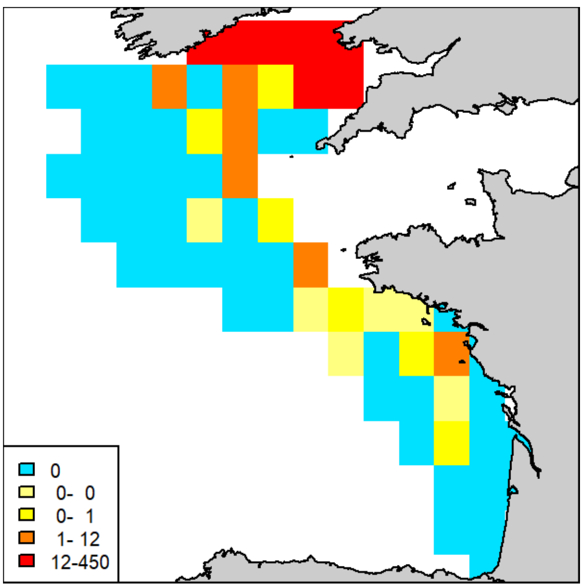


Figure 19.14. Skates in the Bay of Biscay and Iberian Waters. Spatial distribution of *Raja montagui* in ICES divisions 7.f-k and 8.a-c, based on catch in the EVHOE survey from 1997 to 2019.

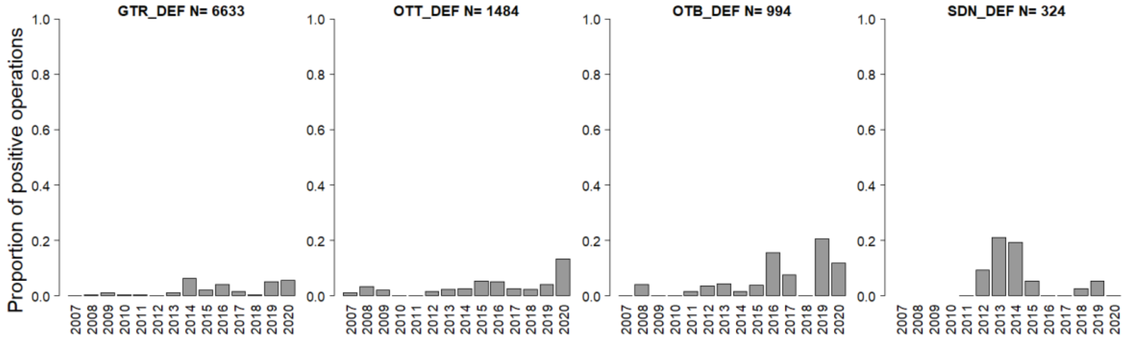


Figure 19.15. Skates in the Bay of Biscay and Iberian Waters. *Raja montagui* in Subarea 8 (rjm.27.8). Occurrence indicators from the French on-board observer trips carried out in application of EU data collection programmes in divisions 8.abd. N: total number of fishing operations observed for the métier from 2007 to 2020.

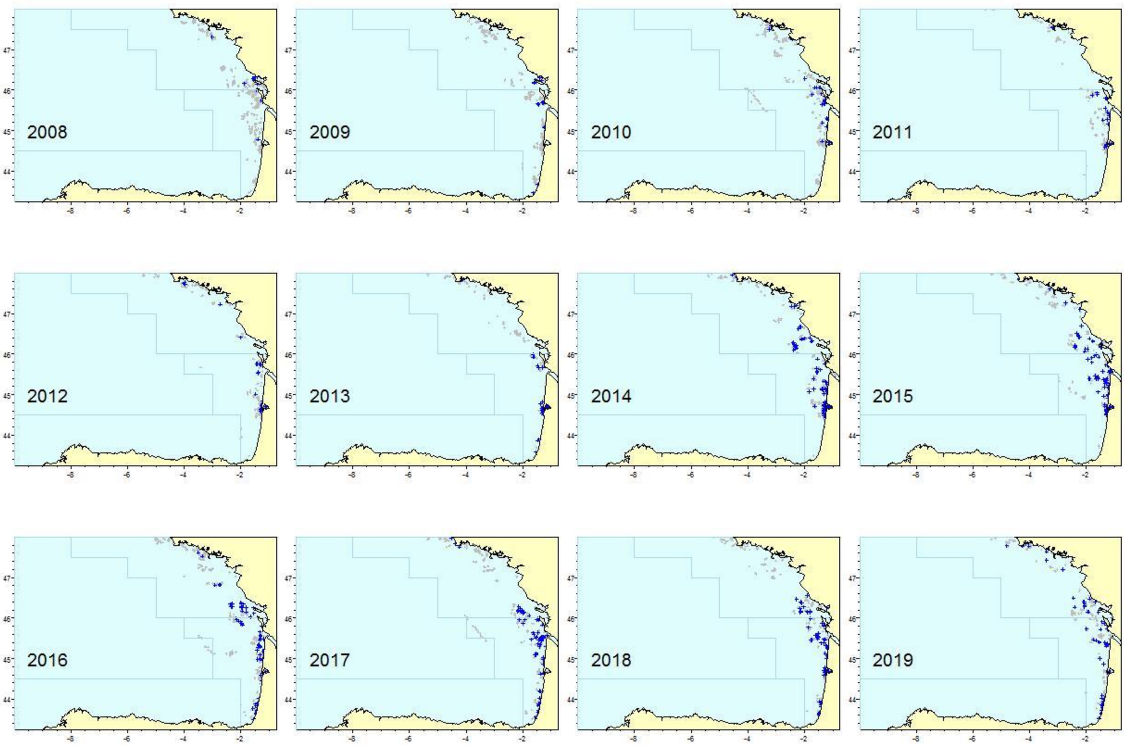


Figure 19.16. Skates in the Bay of Biscay and Iberian Waters. Spatial distribution of catches of *Raja undulata* in divisions 8.ab (rju.27.8ab) in trammel net (DCF level 5 métier GTR_DEF) from French on-board observer trips carried out in application of EU data collection programmes in 8.ab. from 2008 to 2019, grey: locations of all observed fishing operations of the métier, blue: fishing operations with catch of *Raja undulata*. Data used to estimate the frequency of occurrence (Figure 19.13b, leftmost panel).

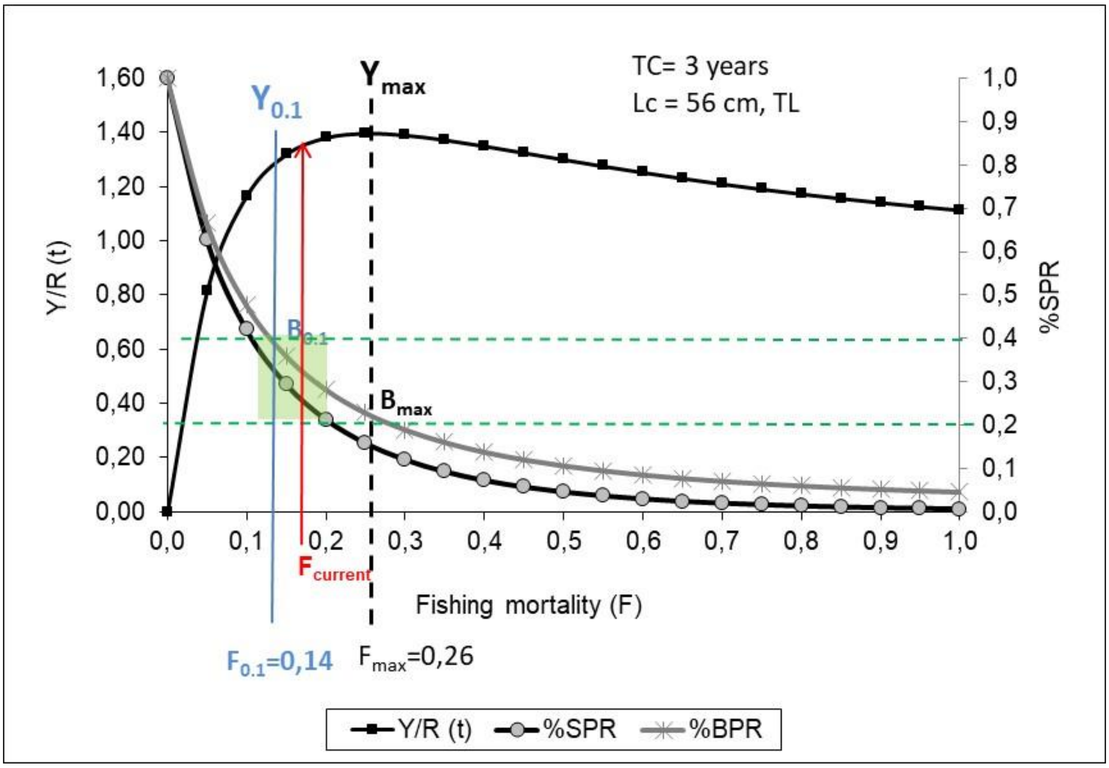
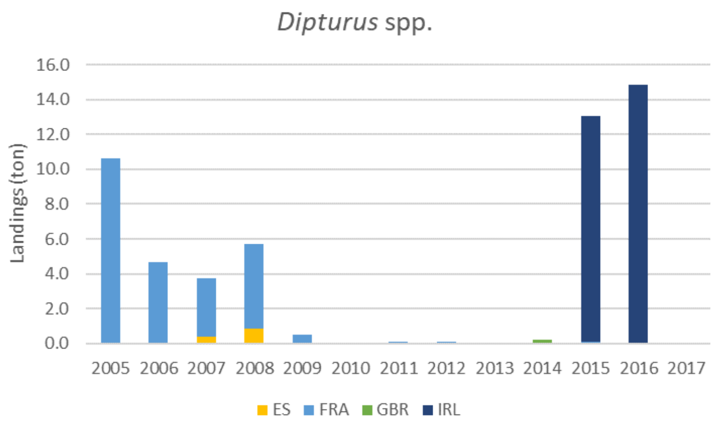


Figure 19.17. Skates in the Bay of Biscay and Iberian Waters. *Raja brachyura* yield per recruit (Y/R and potential spawning ratio (%SPR) curves for different levels of fishing mortality and an age of first capture = 3 years (TC). Red line shows $F_{current}$. *Raja brachyura*.



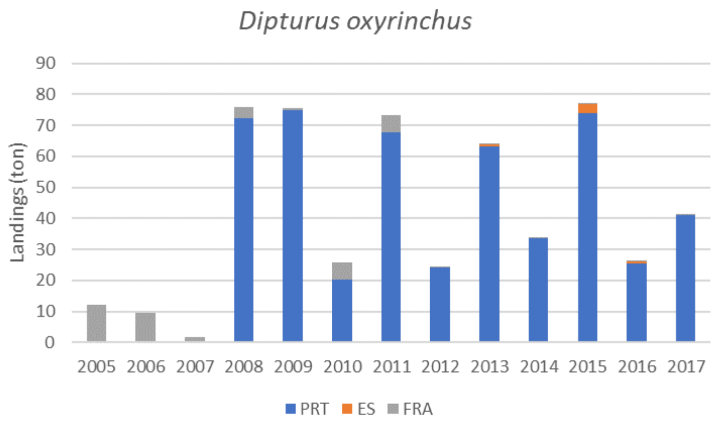


Figure 19.18. Landings (t) of *Dipturus* spp. and *Dipturus oxyrinchus by country* for Subarea 8 and Division 9.a (2004–2017).

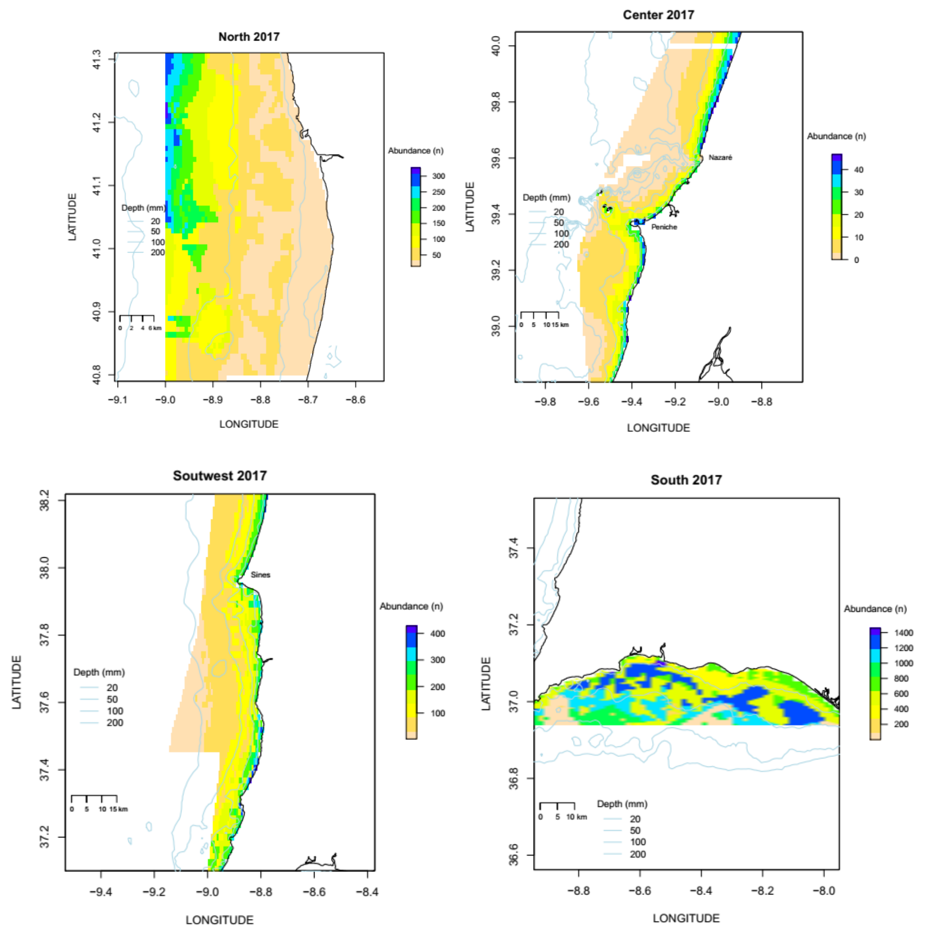


Figure 19.19: Skates in the Bay of Biscay and Iberian Waters. ***Raja undulata*** **potential abundance by region for 2017.**

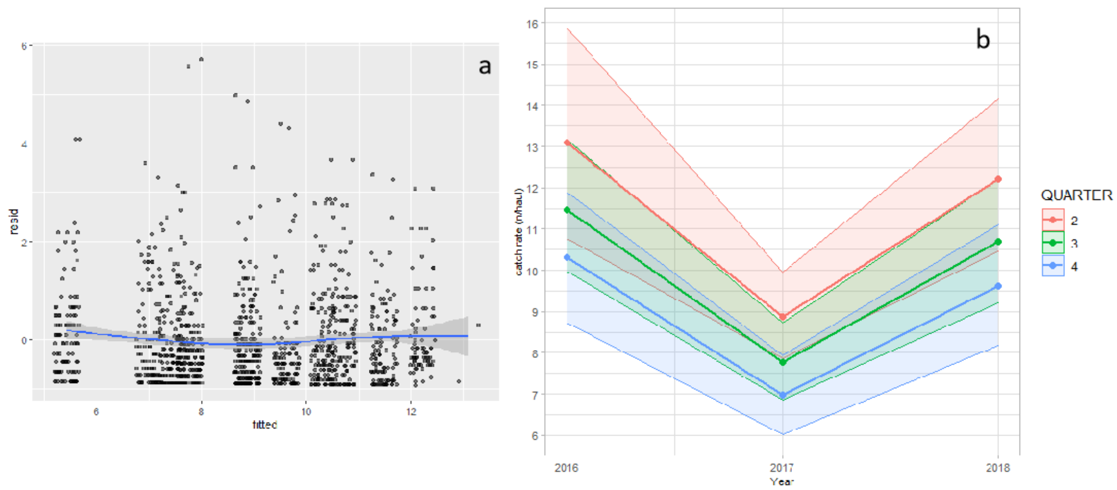


Figure 19.20: Skates in the Bay of Biscay and Iberian Waters. ***Raja undulata*** **a) zero-truncated poisson regression model plot of the residuals versus fitted values and b) Standardized CPUE (kg trip^{-1}) for the period 2016–2018 by year and quarter.**

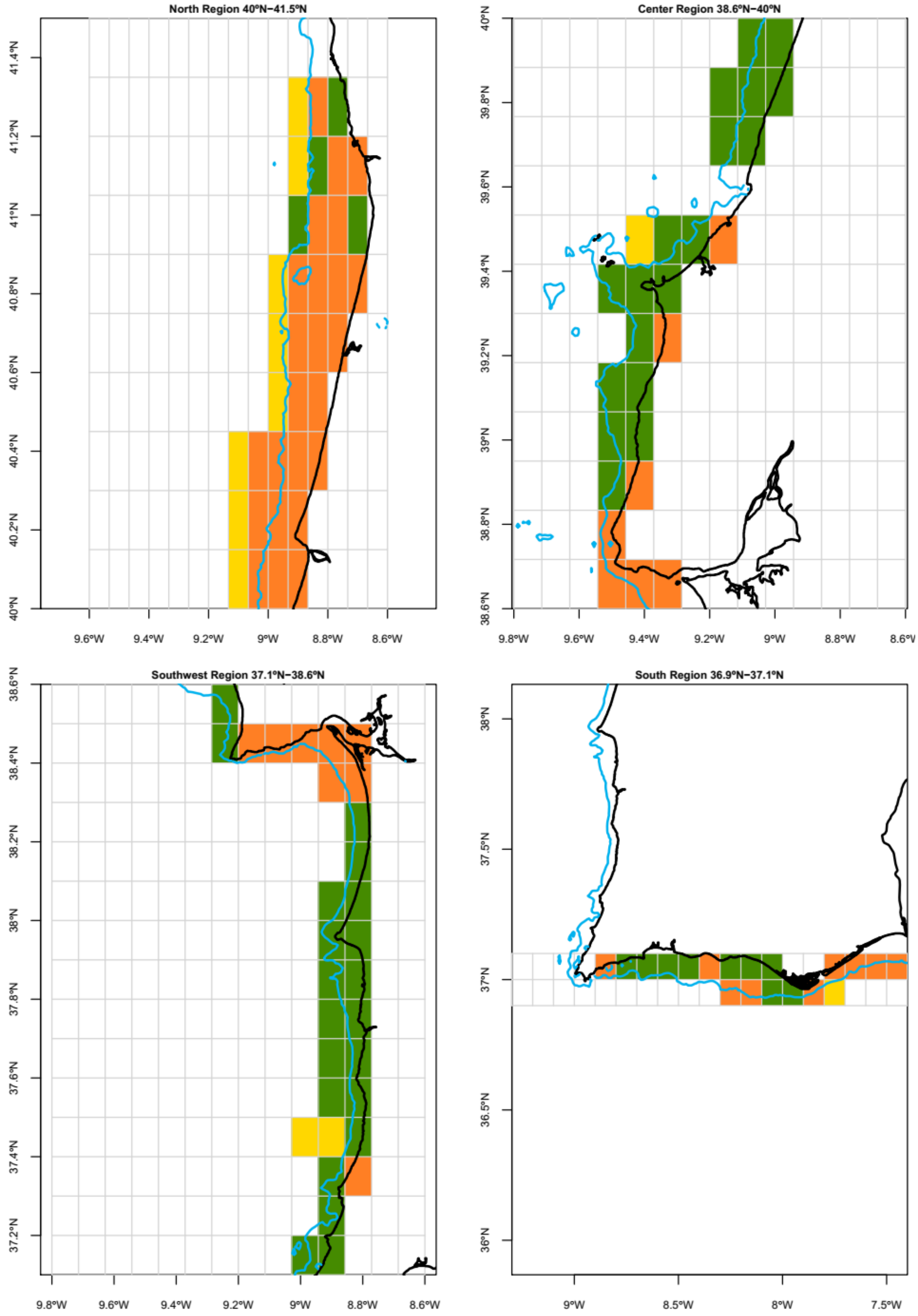


Figure 19.21. Skates in the Bay of Biscay and Iberian Waters. Sampling requirements for full spatial coverage of *Raja undulata* spatial distribution. Green - Spatial cells already sampled in 2016 and/or 2017 that need to continue to be monitored; Orange: - Spatial cells not sampled yet that need to be sampled with priority and; Yellow: Spatial cells not sampled yet that need to be sampled with lower priority.